TYPE

# 76-02A DUAL TRACE PLUG-IN

## Instruction Manual

Serial No. _____

GENERAL ELECTRIC CO.
Instrumentation & Control
228 W. Florence Ave.
Inglewood, Calif. 90301

This Plug-in Module is designed for use with the Fairchild Type 766H Series Oscilloscope. Insert this Manual into the binder you received with the Type 766H Series Instruction Manual.

DUMONT
OSCILLOSCOPE LABORATORIES, INC.
40 FAIRFIELD PLACE WEST CALDWELL, NEW JERSEY 07006

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Manual No. 6704 3274
Code No. 63

# TABLE OF CONTENTS


| Section | Title | Page |
|---|---|---|
| **1.** | **TECHNICAL SUMMARY** | |
| 1-1 | Introduction | 1-1 |
| 1-2 | Technical Summary | 1-1 |
| **2.** | **OPERATING INSTRUCTIONS** | |
| 2-1 | First Time Operation | 2-1 |
| 2-2 | Applying a Signal | 2-1 |
| 2-3 | Balance Adjustments | 2-1 |
| 2-4 | Setting Gain of Dual Trace Amplifier | 2-1 |
| 2-5 | Input Selector Switch | 2-3 |
| 2-6 | Obtaining a Display | 2-3 |
| 2-7 | Additional Hints | 2-3 |
| 2-8 | Use of Probes | 2-5 |
| 2-9 | Dual-Trace Operation | 2-5 |
| 2-10 | Dual-Trace Triggering | 2-5 |
| 2-11 | Dual X-Y Displays | 2-6 |
| 2-12 | Voltage Measurements | 2-6 |
| 2-13 | Measuring Short Rise Times | 2-8 |
| **3.** | **CIRCUIT DESCRIPTION** | |
| 3-1 | Introduction | 3-1 |
| 3-2 | Input Amplifier Circuit Description | 3-1 |
| 3-3 | Electronic Switch Circuit Description | 3-2 |
| 3-4 | Common Deflection Amplifier | 3-4 |
| **4.** | **PERFORMANCE ASSURANCE TEST** | |
| 4-1 | Maintenance Check to Assure Performance | 4-1 |
| 4-2 | Checking Sensitivity of Channels A & B | 4-1 |
| 4-3 | Checking Pulse Response of Channels A & B | 4-1 |
| 4-4 | Checking Bandwidth of Channels A & B | 4-1 |
| 4-5 | Checking Mode Switch | 4-2 |
| **5.** | **MAINTENANCE AND RECALIBRATION** | |
| 5-1 | Introduction | 5-1 |
| 5-2 | Removal and Replacement of Parts | 5-1 |
| 5-3 | Servicing Hints | 5-1 |
| 5-4 | Gaining Access to Chassis | 5-3 |
| 5-5 | Test Equipment Required for Service Adjustments | 5-3 |
| 5-6 | DC Bal Adjustment | 5-3 |
| 5-7 | Gain Adj | 5-4 |
| 5-8 | Trig DC Level | 5-4 |
| 5-9 | High-Frequency Adjustments | 5-4 |
| 5-10 | Input Capacitance Standardization and Attenuator Adjustment | 5-4 |
| 5-11 | Set Attenuator Balance | 5-5 |
| **6.** | **PARTS LISTS AND SCHEMATICS** | |
| 6A | Electrical Parts List | 6-1 |
| 6B | Spare Parts List | 6-5 |
| | List of Recommended Vendors | 6-7 |


## TABLE


| Figure | Title | Page |
|---|---|---|
| 5-1 | Attenuator Compensation Trimmers | 5-5 |


## ILLUSTRATIONS


| Figure | Title | Page |
|---|---|---|
| 1-1 | Type 76-02A Dual Trace, Wide Band, High Gain Plug-in | 1-0 |
| — | Type 76-02A Frequency Response Curve | 1-1 |
| 2-1 | Function of Controls and Connectors | 2-2 |
| 2-2 | Type 76-02A Calibrator Display | 2-4 |
| 2-3 | Peak-to-Peak Voltage Measurements | 2-7 |
| 2-4 | Instantaneous Voltage Measurement with respect to Ground (or some other Reference Potential) | 2-7 |
| 3-1 | Type 76-02A Input Circuit, Functional Block Diagram | 3-1 |
| 3-2 | Type 76-02A Channels A and B Functional Block Diagram | 3-2 |
| 3-3 | Type 76-02A Electronic Switching Circuit Functional Block Diagram | 3-3 |
| 3-4 | Type 76-02A Y Deflection Amplifier Functional Block Diagram | 3-4 |
| 5-1 | Type 76-02A Over-All System Block Diagram | 5-2 |
| 5-2 | Test Setup for Adjusting Input Capacitance | 5-5 |
| 5-3 | Standardizing the Input Capacitance | 5-5 |
| 5-4 | Right Side View Showing Transistors and Attenuator Trimmers | 5-6 |
| 5-5a | Left Side View Showing Pots and Trimmer Adjustments | 5-7 |
| 5-5b | Left Side View Showing Transistors and Nuvistors | 5-8 |
| 6-1 | Front Panel Replaceable Parts | 6-0 |

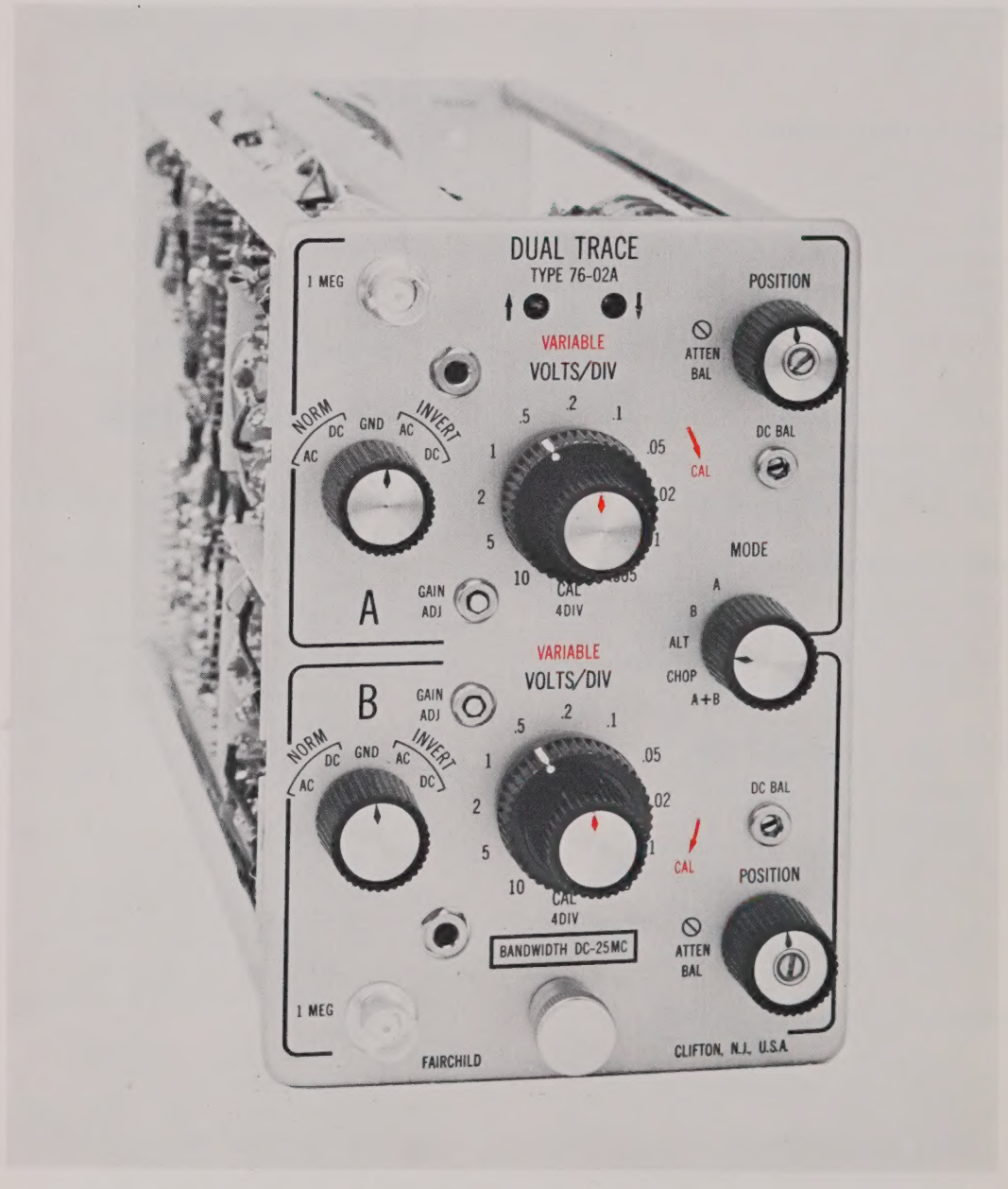



*Figure 1-1. Type 76-02A Dual Trace, Wide Band, High Gain Plug-In*

# SECTION 1
# TECHNICAL SUMMARY

## 1-1. INTRODUCTION

The Type 76-02A Amplifier is a dual-channel amplifier with a bandwidth of 25 megacycles and a sensitivity of 5 millivolts/division. It enables the user to obtain two vertical signals on the screen simultaneously or to display either channel individually. A 230-nanosecond delay is optional in this unit.

The sensitivity of the Type 76-02A Plug-in is variable from 5 millivolts/division to 10 volts/division in 11 steps of 1, 2, and 5 sequence. Accuracy is within 3% at each of the calibrated steps. All frequency measurements are made at 4-division scan.

The VARIABLE gain control, located concentrically with the VOLTS/DIV switch, has a range of greater than 1:2½. This VARIABLE gain control provides continuous overlap between steps of the attenuator (VOLTS/DIV) switch. A detented stop position is provided when the VARIABLE gain control is set to CAL.

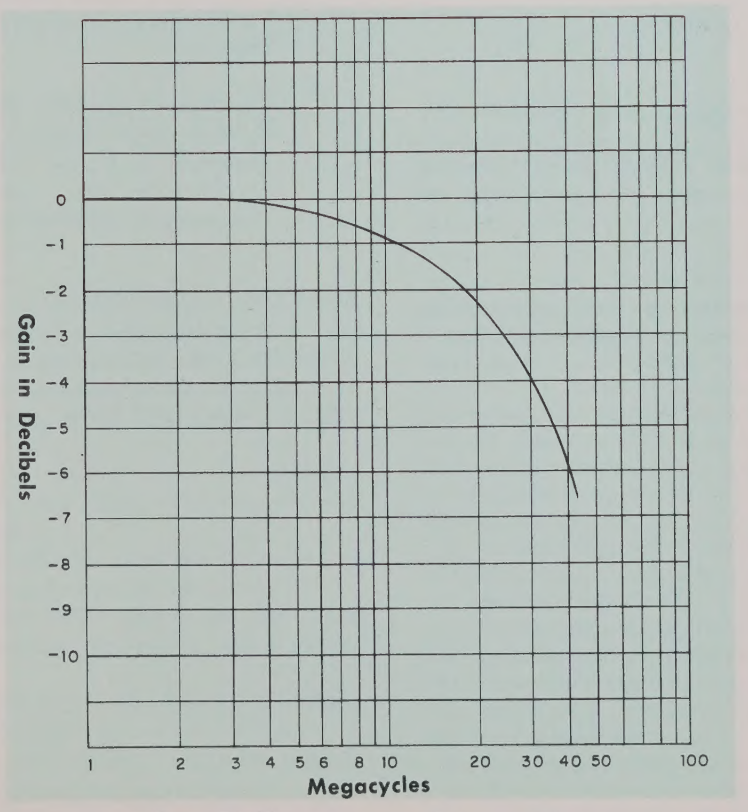
A MODE switch is provided which enables the selection of either Channel A or Channel B for separate display or the sum of both channels for combined display. In addition, ALTernate or CHOPped modes of operation are available. Use of the polarity inversion switch may give A minus B or B minus A presentation when MODE switch is set to A + B.

A front-panel screwdriver GAIN ADJ control is provided on each channel to normalize gain between channels and between the Plug-in and the Main Frame.

The Type 76-02A Amplifier is primarily intended for use in the Y cavity of the Type 765 Series Oscilloscopes. However, this Amplifier may be inserted in the X cavity. When used in this application, the amplifier sensitivity and available scan are reduced by a factor of 2 to 1.

## 1-2. TECHNICAL SUMMARY

The electrical characteristics of the Type 76-02A Dual Trace Amplifier are listed in the performance specifications which follow.




*Type 76-02A Frequency Response Curve*

# section 1 — technical summary

## SPECIFICATIONS

### Y AMPLIFIER

**Bandwidth**

Direct Coupled: DC to 25 megacycles, down 3 db at 25 megacycles (referenced to 50 Kc measured at 4 div p-p)

Capacitively Coupled: Low frequency cutoff is 10 cycles

Rise Time: Less than 15 nanoseconds driven from a 25-ohm source

**Sensitivity**

5 mv/div to 10 v/div in 11 steps of 1, 2, and 5 sequence when VARIABLE gain control is set to CAL; accurate to within ±3% when set on any one step

The VARIABLE gain control permits 2½ to 1 continuous sensitivity adjustments between the VOLTS/DIV steps and extends the 10 volts/div range to 25 volts/div

**Input Impedance**

1 megohm shunted by 40 pf

**Input Selector Switch**

Each channel is provided with a 5-position switch which enables selection of AC or DC coupling with NORMal or INVERTed polarity; grounds amplifier input grid and disconnects input signal when set to GND

**Calibration**

The attenuator includes a CAL position which applies a line frequency square wave signal directly to the input of the Y amplifier to aid in standardizing gain (Cal: 4 div)

**Signal Delay (Optional)**

A 230-nanosecond balanced distributed bifilar helical delay line is provided. This delay is sufficient to view base line and the leading edge of the signal triggering the time base

**Internal Trigger**

An internal trigger take-off amplifier precedes the delay line. This signal is referenced to ground when the trace is positioned to screen center via factory adjustment of the TRIG DC LEVEL control

**Operational Modes**

The following displays are available:

1. A only
2. B only
3. A & B switched alternately
4. A & B time shared (Chopped)
5. A + B (Invert switch permits A-B or B-A presentation)

In chopped operation, the electronic switching rate is greater than 60 Kc; each channel is nominally on 6 μsec and off 9 μsec including the blanking time. Switching transients are automatically blanked

**Beam Position Indicators**

Two indicator lamps are located on the front panel to alert the operator as to the direction of the beam when it is positioned off the screen

# SECTION 2
# OPERATING INSTRUCTIONS

## 2-1. FIRST TIME OPERATION (Figures 2-1 and 2-2)

Unless otherwise designated, it is presumed that the Type 76-02A Plug-in Amplifier is inserted in the Y cavity (left-hand side) and the Type 74-11A Time Base Plug-in is inserted in the X cavity (right-hand side) of the Main Frame. If the Type 76-02A Plug-in unit is inserted in the X cavity of the Main Frame, it will provide horizontal deflection of the trace and the information must be translated accordingly. In the instructions which follow, capital letters within the text indicate front-panel controls, connectors, or settings.

The following illustrations are designed to aid the operator in becoming familiar with the oscilloscope:

Figure 2-1. Function of Controls and Connectors.

Figure 2-2. Type 76-02A Calibrator Display.

## 2-2. APPLYING A SIGNAL

The signal (or signals) to be displayed is applied to either (or both) input connector on the front panel. To insure proper performance, the signal should be applied through a shielded cable, with the shield connected to the chassis of both the oscilloscope and the signal source.

Accessory Probes are available for use with the Type 76-02A Amplifier and are listed in the Type 766H Series Oscilloscope Instruction Manual.

## 2-3. BALANCE ADJUSTMENTS

### a. DC Bal

If the DC balance of the Type 76-02A Amplifier is not properly adjusted, the reference trace on the screen will be depositioned when the VARIABLE control is rotated. To properly adjust the DC BAL front-panel screwdriver control for Channel A, proceed as follows:

1. Set VOLTS/DIV switch to 0.005, Input Selector switch to GND, and rotate VARIABLE control to its minimum gain setting.
2. Adjust the appropriate Time Base Plug-in controls to obtain a reference trace on the screen.
3. Using the POSITION control on the Type 76-02A Amplifier, position the trace to screen center (reference line).
4. Turn the VARIABLE control to the calibrated position and note any deflection.
5. Adjust the DC BAL control until the trace is positioned to the reference line established in step 3. Do *not* change the POSITION control setting.
6. Continue to adjust the DC BAL control until there is no depositioning of the trace when the VARIABLE control is rotated back and forth throughout its range.
7. Repeat above setup (steps 1 through 6) for Channel B.

*Note:* If the adjustment range of the front-panel DC BAL control is insufficient, refer to Section 5, Maintenance and Recalibration, for the complete factory Coarse and Fine DC BAL adjustment procedure.

### b. Atten Bal

When the ATTEN BAL control (screwdriver control concentric with the POSITION knob) is properly adjusted, there will be no depositioning of the trace when the VOLTS/DIV control is activated. To adjust, proceed as follows:

1. Vary VOLTS/DIV switch from 0.005 to 0.1.
2. Adjust ATTEN BAL front-panel screwdriver control until there is no depositioning of the trace when switching the VOLTS/DIV control back and forth.
3. Check the 0.02 and the 0.005-volt ranges; readjust if necessary.
4. Repeat steps 1, 2, and 3 for Channel B.

## 2-4. SETTING GAIN OF DUAL TRACE AMPLIFIER

Whenever the Type 76-02A Amplifier is removed from the Main Frame and inserted in another, the front-panel screwdriver GAIN ADJ control must be reset. This procedure is necessary to compensate for difference in deflection plate sensitivities. In addition, if the Type 76-02A Amplifier is switched from the Y cavity to the X cavity of the same Main Frame, readjustment will be necessary since the difference in average deflection plate voltages between modules affects the over-all deflection sensitivity of the cathode-ray tube. To properly normalize the gain between channels or between the Plug-in unit and the Main Frame, proceed as follows:

1. Set both Channel A and B VOLTS/DIV switches to CAL and turn both VARIABLE controls to CAL.
2. Set MODE switch to A.
3. Adjust the sweep controls for a stable display.
4. Set Channel A front-panel screwdriver GAIN ADJ control for precisely 4 divisions of deflection.
5. Set MODE switch to ALT and adjust sweep rate for 2 mSEC/div.
6. Position the traces one on top of the other.
7. Adjust Channel B GAIN ADJ until only one trace may be observed (traces are superimposed).

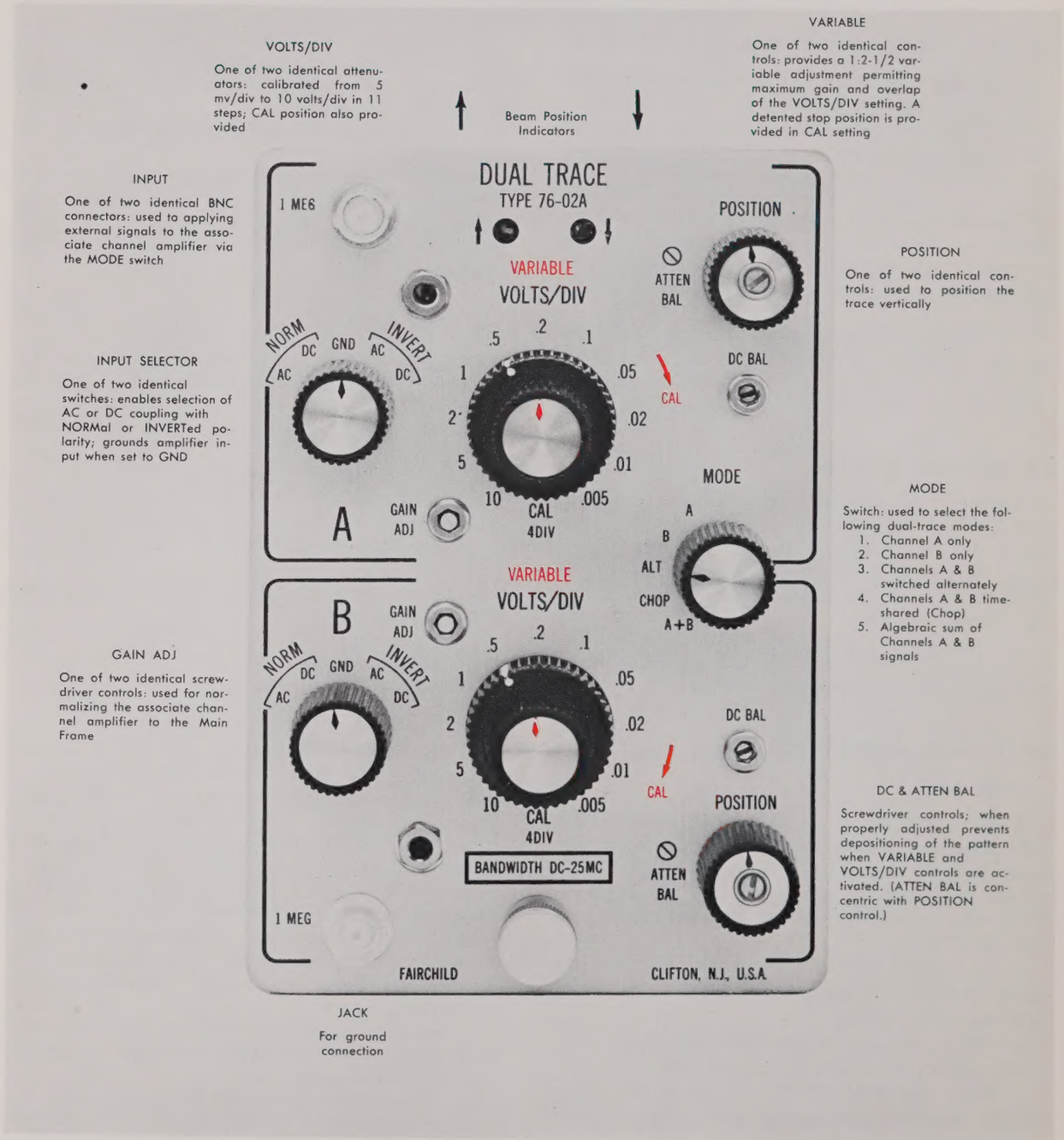



*Figure 2-1. Function of Controls and Connectors*

### 2-5. INPUT SELECTOR SWITCH

Each channel is provided with an Input Selector switch which permits AC or DC coupling of the applied signal and a choice of NORMal or INVERTed polarity. When the Input Selector switch is set to GND, the input circuit of the Type 76-02A is grounded, and the applied signal is disconnected.

The Input Selector switch permits choice of retaining the dc level of the input signal or blocking the dc component of the input signal by inserting a capacitor in series with the input. If it is desired to display both the ac and dc components of a signal, set this switch to NORM DC. Thus, the position of the display at any instant is a function of the instantaneous signal voltage with respect to ground.

There are times when it is neither necessary nor desirable to display the dc component of the input waveform. A capacitor placed in series with the input connector will exclude the dc component while simultaneously permitting the ac component to be displayed. This is accomplished when the Input Selector switch is set to AC. The effects of the dc component is now excluded from the display.

When using the dual-trace features of the Type 76-02A, you may desire to invert the displayed waveform. In the NORM position of the Input Selector switch, the displayed waveform will have the same polarity as the applied signal. When the Input Selector switch is set to INVERT, the displayed waveform will be inverted. In other words, a positive-going pulse will be displayed as a negative-going pulse.

### 2-6. OBTAINING A DISPLAY

To use the Type 76-02A Amplifier to obtain a display, proceed as follows:

1. Signals to be observed are connected to the Type 76-02A Amplifier through the Channel A and/or Channel B connector via shielded cable or an Attenuator Probe.
2. Establish a common ground between the oscilloscope chassis and the signal source.
3. If it is desired to display a single trace with the Type 76-02A Amplifier, simply apply the signal to either Input connector and set the MODE switch to the corresponding position (A or B).
4. To display two signals simultaneously, connect a signal to each Input connector and set the MODE switch to ALT or CHOP. The chopped position is used when it is desired to reduce the "flickering" of the display when observing input signal data at slow speeds (below 1 millisec/div). External triggering of the Time Base is to be preferred in chopped position to prevent the sweep from triggering on the "chopping" signal.

In general, the CHOP position is used with lower sweep rates and the ALT position with higher sweep rates.

5. To display the algebraic sum of two signals, connect a signal to each Input connector and set the MODE switch to A + B.
6. To display the algebraic difference of two signals, apply a signal to each Input connector and set the MODE switch to A + B. For A − B presentation, set Channel A Input Selector switch to NORM and Channel B Input Selector switch to INVERT. For B − A presentation, set A switch to INVERT, and B switch to NORM.
7. Adjust the appropriate Time Base Plug-in controls to obtain a stable display of the pattern.
8. Set the VOLTS/DIV switch and POSITION control such that the size and position of the display is as desired on the screen.

### 2-7. ADDITIONAL HINTS

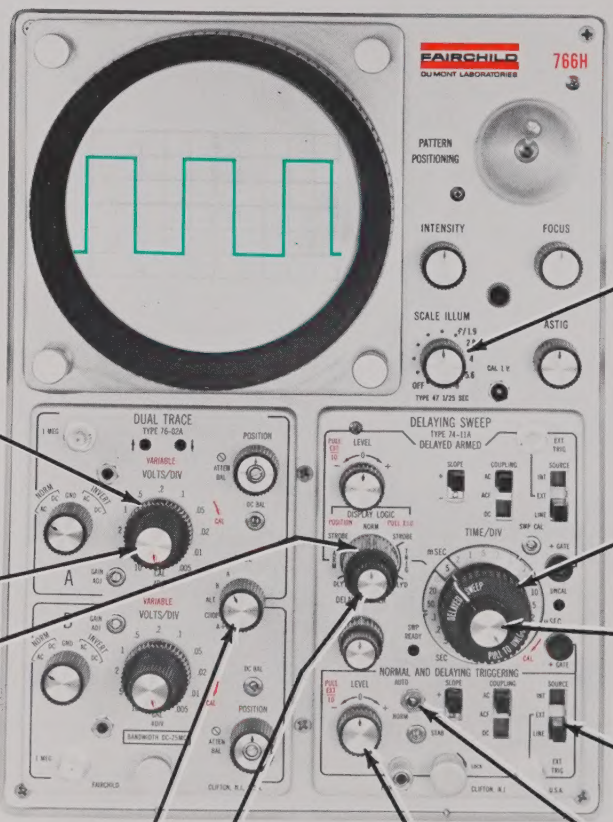
In addition to the information given in the paragraphs preceding, observe the following precautions when applying signals to the oscilloscope:

1. Avoid errors in readings due to stray coupling between circuits, particularly in the signal lead. As a rule, do not use long, unshielded leads for applying signals to the oscilloscope. This fact holds for the audio-frequency spectrum, except possibly when making measurements on low impedance circuits at very low frequencies. Coaxial or shielded input cables are recommended for most applications.
2. In broadband applications, it may be necessary to terminate a coaxial cable with a resistance equal to its characteristic impedance. This is done to prevent standing waves or ringing (high-frequency damped oscillations).
3. To avoid erroneous results, the operator should simulate the actual operating conditions of the equipment being tested. For example, the equipment should work into a load impedance equal to that which it will see in actual use.
4. Consider the effect of loading upon the signal source due to the input impedance of the oscilloscope. The input impedance can be represented by a resistance shunted by a capacitance. The effective value of this impedance is indicated in the Specifications in Section 1. However, the operator should be aware that even with a few feet of cable in the input circuit, the loading capacitance on the circuit under investigation might be greater than 100 pf.
5. There are cases when connecting the input of the oscilloscope to a signal source, the effect of loading the source is not negligible. To minimize this loading and therefore obtain a valid measurement, a probe may be used in the manner described in the paragraph entitled "Use of Probes."
6. Care must be exercised when applying a fast rise, high-frequency signal to the Input connector. It will be necessary to match and properly terminate the coaxial cable applying the signal to the oscilloscope.

NORMAL SWEEP DISPLAY OF CAL SIGNAL

To obtain the calibrator display using NORMAL sweep, set the controls exactly as shown and perform the numbered steps in sequence.

Use the same procedure when difficulty is experienced in obtaining a display. This will eliminate "cockpit" troubles due to misalignment of controls.




Set ASTIG, FOCUS, & INTENSITY controls to center of range

1. Rotate clockwise to turn on the oscilloscope

2. *Set both TIME/DIV "clutched knobs" to 5 mSEC

3. Set VERNIER fully clockwise

4. Set switches to: + AC & LINE

5. Set to AUTO

6. Set to ZERO

7. Set outer knob (VOLTS/DIV) to CAL

8. Rotate inner knob (VARIABLE) fully clockwise

9. Set outer knob (DISPLAY LOGIC) to NORMAL

10. Set MODE switch to A

11. Adjust to center the display horizontally

Readjust (POSITION) control on the Y Amplifier to center display vertically

Readjust INTENSITY, FOCUS & ASTIG controls for a sharp pattern

*The TIME/DIV "clutched knobs" are engaged when the notch on the plastic skirt is aligned with the white pointer on the clutched knob

***Figure 2-2. Type 76-02A Calibrator Display***

7. As the length of the cable is increased, the necessity for proper termination becomes very important. This termination is generally inserted at the oscilloscope end of the cable, although many signal sources may require an additional termination at the other end of the cable. The Type 4285A Termination is recommended for 50-ohm systems.

For rack-mounting systems, observe the following precautions if long shielded cables are used.

1. It may be desirable to ground long shielded leads only at one end to avoid circulation currents. Even microamperes of extraneous currents in the shield braid will cause unwanted distortions.
2. Use cable with insulation over the shielded braid so that the cable does not accidentally touch ground.
3. Use off-ground insulated bulkhead feed-thru connectors where applicable.
4. Do not pass cables near strong ac magnetic fields.
5. Long shielded input cables may also include parasitic oscillations. It is suggested that a 100-ohm to 1000-ohm, ½-watt resistor be connected in series with the center conductor near or at the oscilloscope input terminals.
6. Use a resistance at least twice that required to just stop the parasitic oscillations. Too large a value may reduce the bandwidth of the system.

## 2-8. USE OF PROBES

An attenuator probe lessens both the capacitive and resistive loading caused by the oscilloscope to a minimum value. Simultaneously, while isolating the oscilloscope from the signal source, it reduces the effective sensitivity of the instrument. In other words, the displayed waveform will be reduced in amplitude by the attenuation factor of the probe. The attenuation introduced by the probe permits measurement of signal voltages in excess of those which may be accommodated by the instrument.

When using a probe to sample signals from a tuned, matched, or otherwise critical circuit, capacitive loading may cause erroneous readings. In these cases it may be necessary to remove capacity and resistance from the circuit under observation. When the observations and adjustments are completed, capacity and resistance precisely equal to that of the probe impedance should be added to the circuit, after the probe is removed from the circuit. This substitution will equalize loading and restore the operating characteristics of the circuit under observation to the same conditions when probe measurements were made.

When using the attenuator probe to make amplitude measurements, multiply the observed amplitude of the display by the attenuation factor marked on the probe.

The Accessory Probes listed in Section 1 of the Type 766H Series Instruction Manual have an attenuation factor of 10 to 1. The maximum voltage that may be applied to these probes is 600 volts dc plus peak ac. Voltages in excess of this value (either dc volts or peak ac volts) may cause damage to components inside of the probe housing.

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**IMPORTANT:**

Before using the probe, always check its adjustment.

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An adjustable capacitor in the probe compensates for variations in input capacitances from one unit to another. To insure accuracy in pulse and transient measurements, check the probe adjustment frequently. To check the probe, proceed as follows:

1. Connect the Probe to Input BNC connector on the Type 76-02A and apply the probe tip to the IV CAL pin jack on the Main Frame. Set Selector switch to DC.
2. Adjust the oscilloscope to display several cycles of the calibrator waveform.
3. Adjust the variable capacitor in the body of the probe for a flat-top trace on the screen.
4. To preserve the waveform of the signal being displayed, clip the probe ground lead to the chassis of the equipment being tested. Select a short clean ground point near the probe input connection.

## 2-9. DUAL-TRACE OPERATION

Using the Type 76-02A Dual-Trace Plug-in unit with the Main Frame, makes it possible to view two different time-shared vertical input signals displayed against one time base. The electronic switch will alternately accept either the Channel A or Channel B signal when the MODE switch is set to ALT. Each channel retains individual control of sensitivity, position, polarity, etc. Should the sweep rate be so low that the display has excessive flicker, the MODE switch may be set to CHOP position. The electronic switch will now chop the signals at approximately 60 Kc rate. Switching transients will automatically be blanked for a clean, undistorted display.

The dual-trace display applications include comparisons of the input and output of the amplifiers, multivibrators, shaping circuits, comparative phase and time delay measurements, etc.

Do not use internal triggering when in the chopped mode, since the random switching transients will cause poor synchronization of the sweep.

## 2-10. DUAL-TRACE TRIGGERING

### a. Introduction

For simplicity of operation, dual-trace triggering may be categorized as follows:

1. External triggering using alternate or chopped modes of operation.

2. Internal triggering using the alternate mode.
3. Internal triggering using the chopped mode.

#### b. External TRIG Using CHOP or ALT Modes

For dual-trace operation, it is preferable to trigger the time base with an external signal which bears a fixed time relationship to the applied signal. One of the applied signals may normally be employed as the external triggering signal. When this technique is used, a stable display is more readily obtained, and the true time or phase relationship of the two signals is discernible.

In low-frequency applications, one of the applied signals may be used as the external triggering signal. In general, useful stable displays may be obtained by this technique without excessively loading the signal source. However, in high-frequency applications, such a method for deriving the triggering signal loads down the signal source resulting in an unsatisfactory display. Therefore, a non-loading method must be used for obtaining the external trigger. For example, if the Fairchild Type 781 Time-Mark Generator is the signal source, use the TRIGGER OUT pulse from this generator to externally trigger the oscilloscope.

#### c. Internal TRIG Using ALT Mode

Internal triggering of the time base may be used if the time or phase relationship between the two signals is not critical. In alternate mode of operation, the signal applied to the Type 76-02A internally triggers the Time Base Module, which in turn switches the channels at the completion of each sweep cycle during the retrace intervals.

Hence, it is important to set the Time Base TRIG LEVEL control to a point where the sweep can trigger on the signal applied to each channel. If one of the applied signals possesses a smaller amplitude than the other, then the TRIG LEVEL control must be set for reliable triggering on the smaller amplitude signal to insure the successful operation of the alternate mode switching cycle. Also, to avoid triggering on the change in dc positioning level between channels, set the Time Base Coupling switch to ACF or LF REJECT.

#### d. Internal TRIG Using CHOP Mode

For dual-trace chopped-mode operation, reliable internal triggering may be obtained when the repetition rate of the applied signals is coincident with the chopping rate. If this latter condition is not met, the Time Base Module will endeavor to trigger on the composite chopping-rate signal rather than on the applied signals. In this instance, a stable display may sometimes be obtained by carefully setting the Time Base TRIG LEVEL control to the point where best triggering with minimum jitter is noted. Also use ACF or LF REJECT COUPLING. Refer to any of the Time Base Plug-in Instruction Manuals for further information on triggering.

### 2-11. DUAL X-Y DISPLAYS

It is possible to display two different sets of X-Y parameters on the Type 765 Family of Oscilloscopes through the use of two Type 76-02A Plug-in Amplifiers. This technique is useful if it is desired to observe operating characteristics of two identical items, such as electron tubes, under different operating conditions. To display two sets of X-Y parameters simultaneously, proceed as follows:

1. Insert a Type 76-02A Plug-in into each cavity of the Type 765 Series Oscilloscopes.
2. Set the MODE switch of one plug-in unit to CHOP and the other one to ALT.
3. Apply one pair of signals to the Channel A Input connectors and the other pair of signals to the Channel B connectors.
4. Set the VOLTS/DIV switches and the POSITION controls for the desired display.

### 2-12. VOLTAGE MEASUREMENTS

**NOTE**

When making voltage measurements, make sure there is a common ground between the oscilloscope and the signal source.

#### a. General

The Type 765 Family of Oscilloscopes may be used to measure the voltage of the input signal by using the calibrated VOLTS/DIV setting and observing the height of the display on the screen in graticule divisions.

When making voltage measurements, the operator should try to set up the instrument for full scale vertical deflection to insure maximum accuracy. Also, it is important to remember that the width of the trace may be an appreciable part of the over-all measurement. This is particularly true when you are measuring signals of small amplitude or when stray signal pickup has broadened the trace. The operator should consistently make all measurements from one side of the trace. If the top side of the trace is used for one reading, it should be used for all succeeding readings.

#### b. How to Measure Peak-To-Peak Voltages Using the CRT Scale

The procedure employed for all voltage measurements is basically the same. The VARIABLE control

must be set to CAL. The specific examples that follow are intended to show the general procedure. These examples may be adapted to fit any particular application.

To measure the ac component of the signal on display, set the Input Selector switch to AC. In this position, only the ac components of the input signal are displayed on the screen. However, when the ac components of the input is of very low frequency (under 10 cps), set the Input Selector switch to DC to prevent errors.

To make measurements, proceed as follows:

1. Using the calibrated scale, measure the vertical deflection in graticule divisions from the positive peak to the negative peak of the waveform. See Figure 2-3.
2. Multiply the vertical dimension obtained in step 1 by the VOLTS/DIV switch setting to obtain the indicated voltage.
3. Multiply the indicated voltage obtained in step 2 by the attenuation factor of the probe, if one is used, to obtain the actual peak-to-peak voltage.

For example, suppose that you are using a 10:1 Attenuator Probe and the VOLTS/DIV switch is set to 0.1. Assume that the vertical distance between the peaks of the waveform measures 4 graticule divisions. Now, this graticule dimension of 4 is multipled by the VOLTS/DIV setting of 0.1 to give 0.4 volt. Next, multiply this result by 10, if a 10:1 Attenuator Probe is used. This gives 4 volts as the peak-to-peak voltage of the display waveform.

*Note:* Always make sure that the VARIABLE control is set to CAL when making measurements.

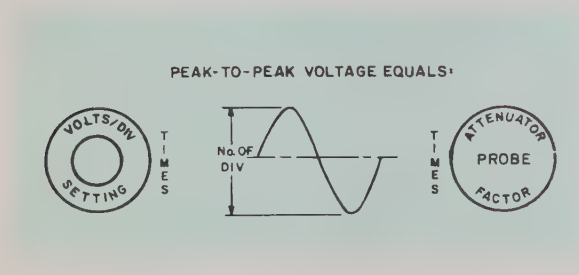



*Figure 2-3. Peak-To-Peak Voltage Measurements*

### c. How to Measure Instantaneous Voltages with Respect to Ground (or some other Reference Potential) Using the CRT Scale

The technique used for measuring instantaneous voltages with respect to a reference point, is virtually the same as that described for peak-to-peak voltage measurements. The difference is that now a reference point must be established on the screen of the oscilloscope. Since voltage measurements with respect to ground are the most common, the procedure which follows, establishes ground as the reference point. The same general technique may be used for instantaneous measurements with respect to any other potential, just so long as that potential is employed to establish the reference point.

To make measurements, proceed as follows:

1. Set the Input Selector switch to DC.
2. Adjust the appropriate Time Base Plug-in controls to obtain a reference trace.
3. To establish the reference point, touch the probe tip to the ground terminal on the oscilloscope (or to the desired source potential, if a point other than ground is used). Vertically position the trace to a convenient point on the screen. This point should be chosen so that it lies on one of the major horizontal scale divisions. The chosen horizontal scale line, which is now coincident with the trace, is the reference line from which all voltage measurements are to be made.
4. Disconnect the probe tip from ground and connect it to the signal source without disturbing the POSITION control.
5. Adjust the oscilloscope controls for a suitable and stable display.
6. Using the calibrated scale, measure the number of graticule divisions from the desired point on the waveform to the pre-established reference line set up in step 3. See Figure 2-4.
7. Multiply the graticule dimension obtained in step 6 by the VOLTS/DIV switch setting to obtain the indicated voltage. Make sure that the VARIABLE control is set to CAL.
8. Multiply the indicated voltage obtained in step 7 by the attenuation factor of the probe used to obtain the actual instantaneous voltage.

For example, suppose that you are using a 10:1 Attenuator Probe and the VOLTS/DIV switch is set to 0.1. Assume that the vertical distance between the desired point on the waveform to the pre-established reference line is 4 graticule divisions. Now, multiply this vertical deflection of 4 divisions by the VOLTS/DIV setting of 0.1 to give 0.4 volt. Next, multiply this result by 10, the attenuation factor of the probe. This shows that the instantaneous voltage with respect to ground to be 4 volts. Since the voltage point is above the reference line, the indicated polarity is positive.

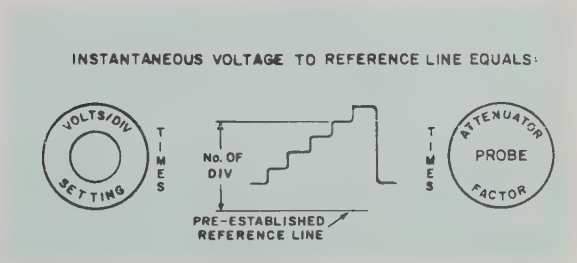
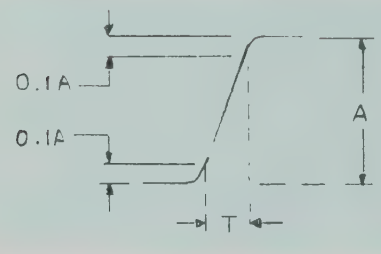



*Figure 2-4. Instantaneous Voltage Measurement with respect to Ground (or some other Reference Potential)*

### 2-13. MEASURING SHORT RISE TIMES

The rise time is defined as the time between 10% and 90% of the amplitude.




Connect the circuit under investigation with a 50-ohm cable RG-8A/U, terminated with a Type 7093 pad to the input of the oscilloscope. The rise time of the circuit is expressed in the form

$$T = \sqrt{T^2_{crt} - T^2_{ampl}}$$

in which $T_{crt}$ is the measured rise time on the oscilloscope and $T_{ampl}$ is the rise time of the Type 76-02A which is 15 nanoseconds.

Using a Type 4285A 50-ohm termination, the amplifier rise time is 15.5 nanoseconds due to the loading effect of the 40 pf input capacitance. The Type 7093, 50-ohm 5:1 pad is recommended for short rise time measurements. The display of the pulse should be within the quality square of 6 divisions to avoid saturation of the output tubes and related distortion of the pulse response.

# SECTION 3
# CIRCUIT DESCRIPTION

## 3-1. INTRODUCTION

To simplify circuit description of the Type 76-02A Dual Trace Amplifier, functional block diagrams are provided as follows:

Figure 3-1. Type 76-02A Input Circuit, Functional Block Diagram

Figure 3-2. Type 76-02A Channels 1 & 2, Functional Block Diagram

Figure 3-3. Type 76-02A Electronic Switching Circuits, Functional Block Diagram

Figure 3-4. Type 76-02A Y Deflection Amplifier, Functional Block Diagram

Refer to Figure 5-1 in the Maintenance and Recalibration Section for the over-all system block diagram.

The circuit description will be keyed to the above-mentioned illustrations. Emphasis is placed on the interrelation of circuits rather than on detail of operation. It is also recommended that the schematics at the rear of the manual be referred to in following the circuit description.

## 3-2. INPUT AMPLIFIER CIRCUIT DESCRIPTION

### a. Input Channel (Figure 3-1)

The Type 76-02A Plug-in is a two-channel amplifier designed for use with the Type 765 Series Oscilloscopes. It consists of two identical input channels (Channel A and Channel B), an electronic switching system, and a common vertical deflection amplifier. The output of either or both input channels may be applied to the common vertical amplifier depending on the setting of the MODE selector switch.

Each input channel consists of an attenuator and a preamplifier. Since the input channels are identical, the circuit description will refer to Channel A only. Operation of Channel B will be the same as A except where otherwise noted.

The Input Selector switch permits choice of retaining the dc level of the input signal or blocking the dc component of the input signal by inserting a capacitor in series with the input. When this switch is set to the NORMal sector, the displayed waveform will have the same polarity as the applied signal. The displayed waveform will reverse polarity when the switch is set to the INVERT sector. If this switch is used when the MODE switch is set to A + B, the unit may be set up for A minus B or B minus A presentation. A GND position is provided on the Input Selector switch to facilitate the dc balancing of the input amplifier. The VOLTS/DIV switch permits the desired attenuation

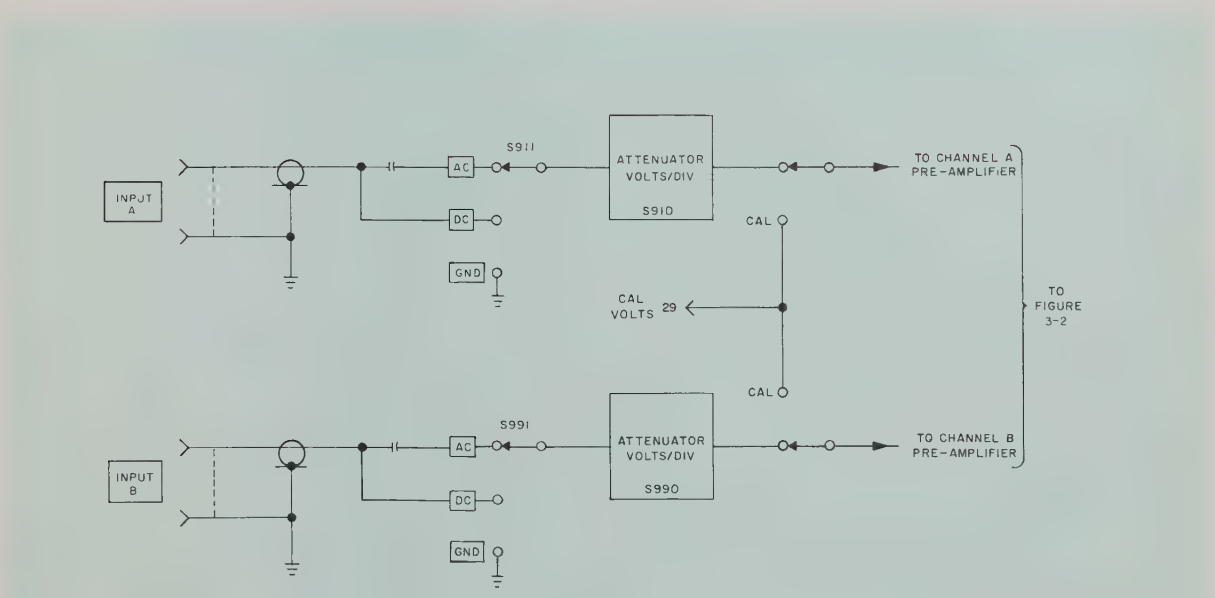



*Figure 3-1. Type 76-02A Input Circuit, Functional Block Diagram*

of the input signal in calibrated steps as indicated by the front-panel markings.

An internal calibrating voltage is applied to the vertical input dc amplifier when the VOLTS/DIV switch is set to CAL. This automatically disconnects the Y Input signal from the amplifier when the calibrator signal is applied. The GAIN ADJ front-panel screwdriver control is employed to normalize the gain between channels and between the Plug-in module and the Main Frame. When gains are normalized, the peak-to-peak value of the calibrator waveform will indicate 4 divisions of vertical deflection on the screen.

### b. Pre-Amplifier (Figure 3-2)

The nuvistor amplifier V920 and V921, converts the single-ended input signal at the grid of V920 to a push-pull output signal at the collectors of Q9200 & Q9201.

Resistors R9207 and R9209 in series with the grids of these tubes, serve to suppress any parasitic high-frequency oscillations. Resistor R9206 is provided to limit grid current in the event that any excess voltage is applied to the input.

The VARIABLE control is connected between the cathode of V920 and V921 in the gain control stage. Any difference in the dc level between the two cathodes will cause the trace to shift vertically as the VARIABLE control is rotated. The DC BAL control nulls the dc voltage across the VARIABLE control, so that in the absence of an input signal, there will be no depositioning of the trace when the VARIABLE control is rotated throughout its range.

Since the emitter loads of Q9202 and Q9203 are tapped down on the three most sensitive ranges of the VOLTS/DIV switch, the attenuator requires balancing. The The ATTEN BAL control is provided to equalize the emitter voltage of Q9202 and Q9203. In this way, tapping down on the load between these emitters does not reflect as pattern positioning changes on the screen in the absence of input dc signal. Therefore, when the attenuator is balanced, there will be no depositioning of the trace.

The POSITION control is introduced across the emitters of amplifier Q9204 and Q9205 and allows vertical positioning of the trace. Also, these amplifiers are switched on or off by the electronic switching circuits so that the modes of operation as indicated by the front-panel MODE switch can be obtained.

## 3-3. ELECTRONIC SWITCH CIRCUIT DESCRIPTION (Figure 3-3)

### a. Blanking Multivibrator

Selection of the input channel whose output is to be applied to the common vertical deflection amplifier, is accomplished by means of the Electronic Switching circuit.

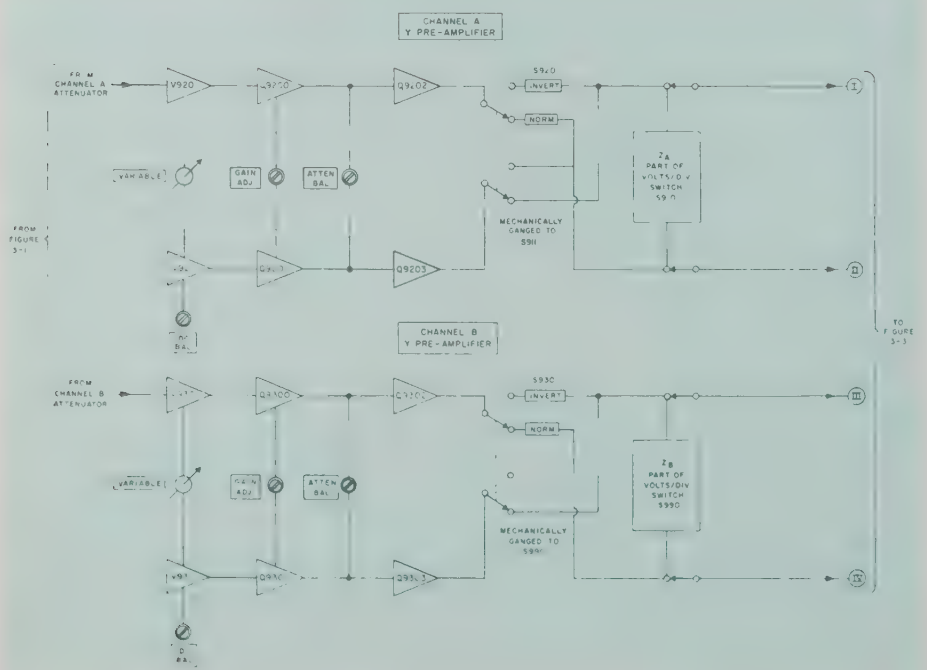



*Figure 3-2. Type 76-02A Channels A and B, Functional Block Diagram*

The timing of the electronic switch Q9600 and Q9601, is provided by the blanking multivibrator Q9701 and Q9702. The blanking multivibrator may be switched to either a monostable or a free-running condition by the MODE switch S960. When the MODE switch is set to A, B, A +B, or ALT, a negative bias is applied through resistor R9705 and diode CR9708 to the base of transistor Q9702. This action locks the blanking multivibrator in the monostable state with Q9702 turned off and Q9701 turned on.

When the MODE switch is set to CHOP, this bias voltage is removed, permitting free-running operation of this stage. This gating voltage is applied to the electronic switch which alternately functions to turn Channels A and B off and on at a 60-Kc rate, independent of the sweep rate. Each channel is *on* approximately 6 microseconds, and *off* for 9 microseconds including the blanking time.

External triggering of the Time Base is to be preferred in the chopped position to prevent triggering of the sweep on the *chopping* signal.

The timing of the blanking multivibrator is determined by the master trigger from the unblanking amplifier of the Time Base unit. This positive-going master trigger is coincident with the trailing edge of the sweep gate and is applied through the series coupling diode CR9704 to the base of Q9702, turning it on momentarily. Consequently, one narrow negative pulse is generated at the collector of Q9702 for each positive trigger input. However, in the free-running position only, the output of the blanking multivibrator is independent of the input triggering signal.

It is necessary to turn off the cathode-ray tube beam as the switching between channels occurs. This is accomplished by applying the negative pulse generated at the collector of Q9702 to the switch-transient blanking amplifier Q9703. The resulting +35-volt blanking pulse is applied to pin 4 of the interconnecting plug to the cathode of the CRT.

### b. Electronic Switch

When the MODE switch is set to A + B, the B+ voltage for the electronic switch Q9600 and Q9601, is disconnected. This allows both pre-amplifier channels to work simultaneously, thus providing a computer type algebraic adder circuit for Channels A and B. Use of the INVERT switch (polarity inversion) may give A minus B or B minus A presentation.

Due to loading of one channel by the other, the bandwidth of the system is reduced slightly in this position.

In positions A or B of the MODE switch; a cut-off bias is applied to the appropriate side of the electronic switch, holding the inactive channel in a continual cut-off position. In other words, the electronic switch is locked, (Q9600 is continually on, and Q9601 is continually off, or vice versa) and will not respond to the triggering signals from the blanking multivibrator.

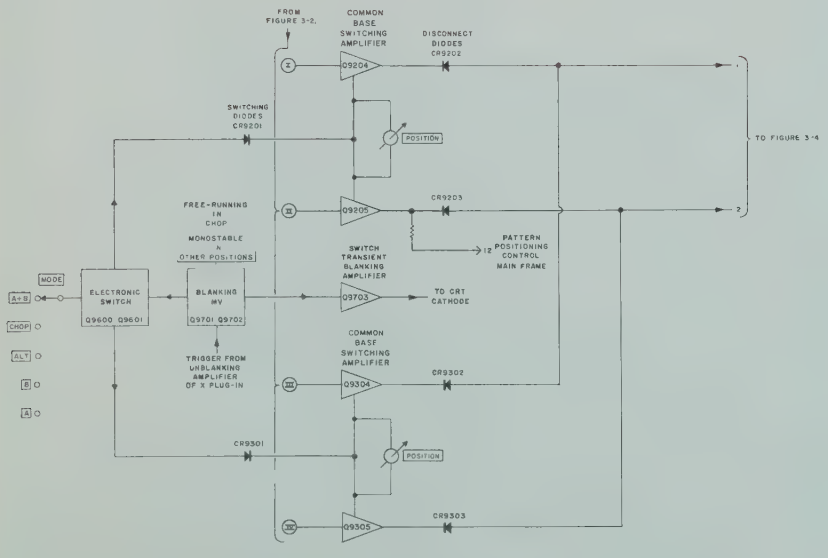



*Figure 3-3. Type 76-02A Electronic Switching Circuit Functional Block Diagram*

For example, when the MODE switch is set to B, a fixed bias is applied through R9605 to the base of Q9600, cutting it off; at the same time, Q9601 is fully conducting. The elevated voltage at the collector of Q9600 is applied to the anode of switching diode CR9201 causing it to conduct. The emitters of Q9204 and Q9205 are raised, thus plunging this stage into cutoff. Hence, Channel A pre-amplifier output is arrested at this point.

Switching diode CR9301, connected between the electronic switch and Channel B switching amplifier, is back-biased by the depressed voltage from Q9601. This permits the emitters of Q9304 and Q9305 to operate at their normal bias. Thus, only Channel B output progresses to the common vertical deflection amplifier.

When the MODE switch is set to A, just the opposite condition exists. Channel B stage, Q9304 and Q9305, is cutoff and Channel A stage, Q9204 and Q9205 conducts.

Diodes in the collector leads of each of the switching output stages of the pre-amplifier disconnect the collectors when the amplifier is turned off. This technique isolates the active adjacent channel collectors which would otherwise be in parallel with the inactive channel and cause capacitive loading. In this way, the maximum available bandwidth may be maintained.

In the ALT or CHOP positions of the MODE switch, no fixed bias is applied, thus permitting the electronic switch to be keyed at will by the blanking multivibrator. Thus, Q9600 and Q9601 become a bistable switching multivibrator.

When the MODE switch is set to ALT, the cathode-ray tube displays the signal in one channel for one sweep of the beam, and the signal in the other channel for the next sweep of the beam.

### 3-4. COMMON DEFLECTION AMPLIFIER (Figure 3-4)

The output from the channel switching amplifier is applied to the common emitter followers Q9400 to Q9403. A Type 7001 balanced distributed bifilar helical delay line is available as an accessory. The delay provided is sufficient to view base line and the leading edge of the signal triggering the time base, when the instrument is set up for internal triggering.

Proper delay line termination is provided by filters Z9401 and Z9402 which compensates for the input capacities of transistors Q9413 and Q9414 respectively.

Just before the delay line is encountered, a portion of the signal from the common emitter followers Q9402 and Q9403, is applied to the trigger pick-off amplifier. This latter circuit, Q9501 to Q9503, provides an internal trigger signal for firing the time base circuit as desired.

When using the dual trace feature of this Plug-in for internal triggering of the time base, always use ACF coupling to avoid triggering on the change in dc positioning level between channels. All signals having low-frequency components above 10 Kc should use external trigger coupling.

A network consisting of R9254, R9255, R9256, R9261, C9218 (sheet 2 of schematic), R9443 and R9444 (sheet 3 of schematic), provides a feedback circuit to preserve the input signal waveform as it progresses through the amplifier.

The output from the delay line (if one is used) or from the preceding stage, is applied to a series of transistorized amplifiers denoted as the drivers. These drivers provide the necessary power requirements for driving the vertical deflection plates of the CRT.

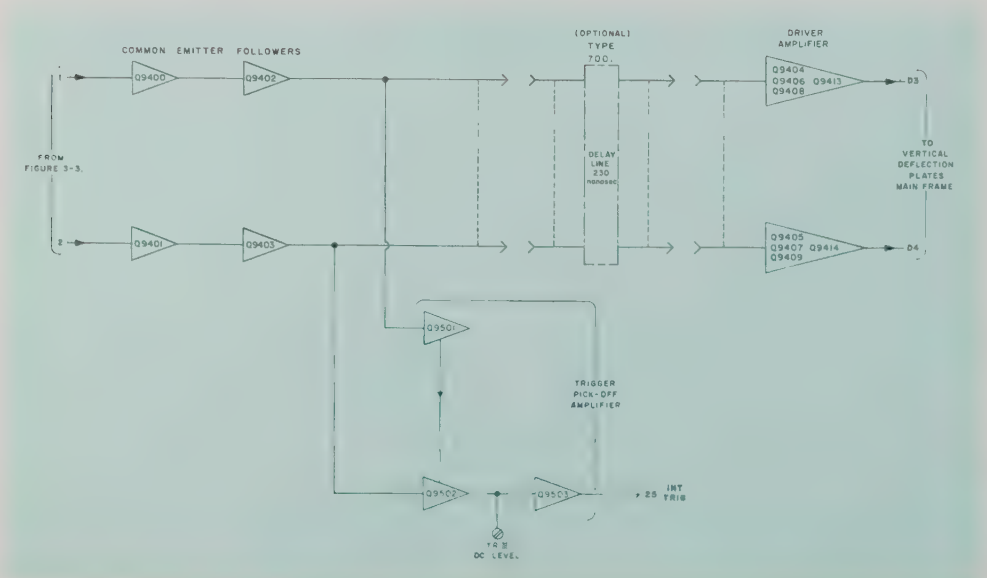



*Figure 3-4. Type 76-02A Y Deflection Amplifier Functional Block Diagram*

# SECTION 4
# PERFORMANCE ASSURANCE TEST

### 4-1. MAINTENANCE CHECK TO ASSURE PERFORMANCE

The tests described in the paragraphs to follow should be performed by Instrument Test Departments and Maintenance Laboratories to certify proper performance. These tests are divided into sections for simplification and to assist those test groups where complete checking is not mandatory, or where all test equipment is not available. Refer to Section 5, paragraph 5-5, for list of test equipment required.

All tests are performed with a representative Type 765 Series Main Frame Oscilloscope and a Time Base Plug-in. Both of the plug-in units must be normalized to the Main Frame before starting tests. This is accomplished by adjusting the front-panel screwdriver SWP CAL and GAIN CAL controls as described in the appropriate plug-in Instruction Manuals. Allow 30 to 60 minutes of warmup time before making any adjustments.

---

**NOTE**

If this Plug-in module is checked by a Receiving Inspection laboratory, the tests outlined below are recommended to certify performance. This instrument has been thoroughly tested and aged at the factory. Nevertheless, rough shipment, extreme environments, or long idle periods may necessitate minor adjustments of the controls. Hence, it is suggested that the certifying engineer try the recommended adjustments not only for recentering the controls, but also to ascertain their range and to familiarize himself with this precision instrument. If, after performing all the tests outlined in the paragraphs to follow, the instrument will not perform to specification, the assistance of the local Fairchild Field Engineering representative should be requested.

---

### 4-2. CHECKING SENSITIVITY OF CHANNELS A & B

1. Set VOLTS/DIV switch and VARIABLE control to CAL.

2. Adjust Time Base unit for a sweep rate of 10 msec/div and observe 6 cycles of calibrator waveform at 60-cycle line. (5 cycles for 50-cycle line.)

3. Adjust DC BAL control after unit has been operating 60 minutes or more.

4. Check range of GAIN ADJ screwdriver control, it should control the amplitude of the calibrator signal over a range from 3.2 to 4.2 divisions peak-to-peak.

5. Set GAIN ADJ control for precisely 4 divisions.

### 4-3. CHECKING PULSE RESPONSE OF CHANNELS A & B

1. Connect a Fairchild Type 791 Square Wave Generator SOURCE IMPEDANCE switch set to 50 ohms, to the Type 76-02A through a 50-ohm cable, 10 db General Radio Attenuator and Type 4285 50-ohm termination. Use external cable delay and external trigger on the Type 74-03A when the Type 7001 Delay Line accessory is not used. Use internal trigger when the Type 7001 is included.

2. Set VARIABLE control to CAL. Unit must have warmed up 30 to 60 or more minutes before any checks are valid.

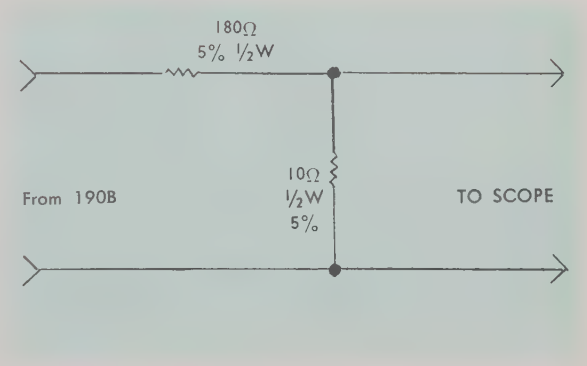
3. Observe a 20 mv peak positive rise on the Type 766H.

*Note:* The overshoot or preswing should be less than 0.25 division and ringing should be less than 2 line widths.

Fall time (10% to 90%) should be 15 nanoseconds or less. This includes the fall time of the Type 791 Square Wave Generator.

### 4-4. CHECKING BANDWIDTH OF CHANNELS A & B

1. Apply 50 Kc output of Tektronix Type 190B Signal Generator to Y Input connector through adapter. (See sketch.)




***Adapter For Type 190B***

2. Set VOLTS/DIV switch to 0.005 and adjust Time Base unit for RECUR sweep of 0.1 μsec/div.

3. Adjust test setup for precisely 4 divisions of vertical deflection.

4. Set Generator to high range and set frequency to 25 Mc. The sine wave amplitude at this frequency should have range of 2.4 to 3.2 divisions.

### 4-5. CHECKING MODE SWITCH

1. On A, check that A POSITION potentiometer controls the display.

2. On B, check that B POSITION potentiometer controls the display.

3. On ALT, check that A & B POSITION potentiometers control their respective displays. Vary the sweep rate from high to low sweep speeds.

4. On CHOP, check that A & B POSITION potentiometers control their respective displays.

5. On A + B, check that A & B POSITION potentiometers control the display.

# SECTION 5
# MAINTENANCE AND RECALIBRATION

## 5-1. INTRODUCTION (Figure 5-1)

This section of the Instruction Manual contains service information and procedures for internal adjustments. Refer to Figure 5-1 for an over-all functional block diagram of the Type 76-02A system.

## 5-2. REMOVAL AND REPLACEMENT OF PARTS

If it is necessary to order a replacement component from the factory, always give the Type Number and Serial Number of the instrument. Before ordering parts for in-warranty replacement or purchasing them for out-of-warranty replacement, be sure to consult the Parts List in this manual. The Parts List gives the values, tolerances, ratings, and the factory part number for all electrical components used in the instrument. This will help to expedite service.

Since your instrument left the factory, some of the parts may have been superseded by improved components. In such cases, the part numbers of these new components will not be listed in your Parts List. However, if you order a part from the factory, and it has been superseded by an improved component, the new part will be shipped in place of the part ordered.

It is the aim of the Fairchild organization to make available the most reliable commercial oscilloscopes within the state of the art and to provide services which will help the user to rapidly restore any of our equipment to its specified performance. Your local Field representative maintains a limited number of spare parts. Also, the factory may be asked to airship replacement parts on a rush basis.

## 5-3. SERVICING HINTS

General maintenance and trouble shooting information is given in the Type 766H Series Oscilloscope Instruction Manual. In the following discussion, it is assumed that you have already read that information and have definitely isolated a trouble in this Plug-in Module.

In trouble-shooting a Plug-in unit, it becomes necessary to determine if the defect is in the plug-in or in the Main Frame of the oscilloscope. The quickest and easiest way of isolating the trouble is to substitute another plug-in unit and determine if the same trouble persists. If the trouble continues after substitution, it can be safely assumed that the defect is in the Main Frame.

There is no simple way of locating troubles. An understanding of the functions of the circuits is the the best help. With an understanding of the circuit operation, it will be possible to make a good guess at the general source of troubles from the symptoms. As an aid in trouble shooting this unit, refer to the system block diagram in this Section and also to the schematics.

To keep electronic units operating at top performance, it is desirable to check the equipment at regular intervals. The period between checks will depend on the installation and the conditions of operation. For these regular checks, clean all dust and dirt from the unit using a light air blast or soft brush. However, to insure the reliability of measurements, we suggest that you recalibrate the Plug-in after each 500 hours of operation or every six months if used intermittently. Also, the calibration of a unit should always be fully checked and adjusted after the repair of replacement of any component in the unit. The complete adjustment procedure for this unit is given in this Section of the Instruction Manual.

In the event of improper performance of the Plug-in unit, the following suggestions are recommmended:

1. The Type 4294 Extension Cable for remote operation of the plug-in from the oscilloscope is available as an accessory. This plug-in extender will be helpful for routine maintenance and recalibration. Do not use this extension for HF alignments; instead, remove the Main Frame side cover.

2. A Type 766 Test Oscilloscope is recommended for localizing troubles, especially when servicing a Type 76-02A inserted in a Type 767 Oscilloscope. To check waveforms, use a high-impedance probe while trouble shooting.

3. Maintain a high quality of workmanship. Use a clean bench and soldering iron; keep solder joints smooth and bright; do not overheat any component while soldering. Use heat sinks when soldering semiconductors. The use of a 30-watt iron such as a Hexacon Type 26S is recommended.

4. When using accessory probes or adapters, be sure the trouble is not originating in the accessory before suspecting the instrument itself.

5. Once the defective stage has been localized, the component or components causing the trouble can be located by tube and component substitution or by voltage measurement. Key voltage measurements are shown on the over-all schematics at the rear of this manual.

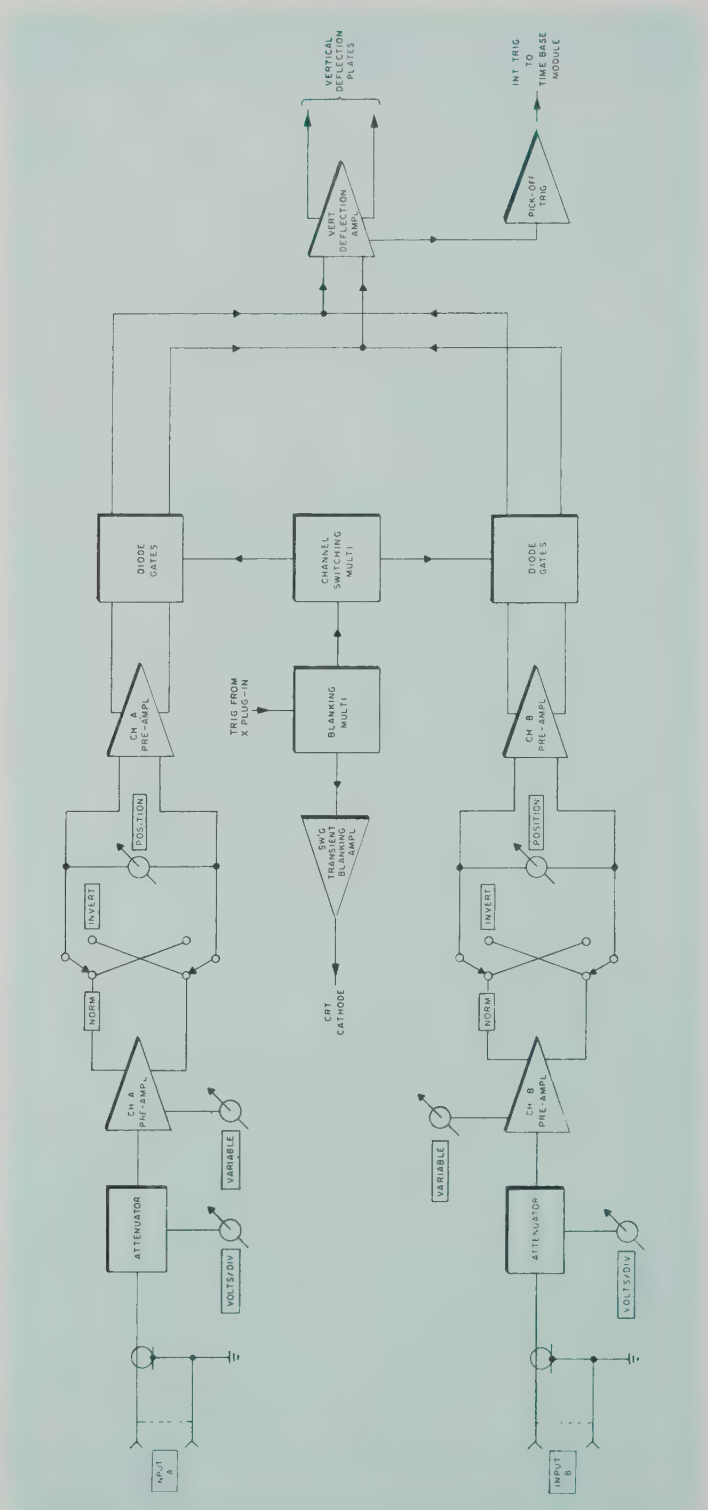



*Figure 5-1. Type 76-02A Over-All System Block Diagram*

6. Electron tubes, semiconductors, and service adjustments are identified on photographs located in this Section of the manual.

*Note:* Be sure and replace the beryllium oxide insulating washers (they serve as heat sinks) on the transistors that require them. Always grease these heat sinks with Dow Corning silicon grease for optimum heat transfer.

## 5-4. GAINING ACCESS TO CHASSIS

Since the Plug-in is not contained in its own dust cover, most of the components are readily accessible when the plug-in is removed from the Main Frame. To gain access to the chassis, simply unscrew the knurled thumbscrew at center bottom of unit and pull it free of the Main Frame.

**WARNING**

WHEN THE PANELS OR PLUG-INS ARE REMOVED FROM THE INSTRUMENT FOR SERVICING, EXERCISE CAUTION WHILE THE POWER IS ON. The lower-voltage busses are potentially more dangerous than the cathode-ray tube potential because of the high current capabilities and large filter capacitors employed in these supplies. When you reach into the instrument with one hand while it is turned on, do not grasp the metal frame with the other hand. If possible, stand on an insulated floor and use insulated tools. It is advisable to ground the third lead in the power cord whenever the instrument is in use.

*Note:* Always use insulated tools while working or making adjustments on the unit when power is on. The transistors in this instrument may be damaged if over-voltaged by accidental grounding of one or more elements. Exercise caution and turn off power when making repairs.

## 5-5. TEST EQUIPMENT REQUIRED FOR SERVICE ADJUSTMENTS

### a. Introduction

The adjustments outlined in the following paragraphs are based on the test procedure followed at the factory. All adjustments should be made at mid-line voltage, 115V/230V ±2%.

To set up the Amplifier Plug-in unit for calibration, insert the Amplifier Plug-in and the Time Base Plug-in into the Main Frame. The Time Base Plug-in module and Main Frame must be fully tested and certified units.

### b. Test Equipment Required (Equivalent may be substituted)

| Equipment | Description |
|---|---|
| Oscilloscope | Fully certified and tested Type 766 Main Frame |
| X Plug-In | Type 74-03A |
| Volt-ohmmeter | Simpson Model 260; 20K ohms/volt sensitivity |
| Square Wave Generator | Fairchild Type 791A |
| Sine Wave Generator | Tektronix Type 190B Constant Amplitude Sine Wave Generator and Adapter |
| 5:1 Termination Pad | Fairchild Type 7093 |
| Capacitance Standardizer | Fairchild Type 7012A |
| Extension Cable for Remote Operation of Plug-in | Fairchild Type 4294 |
| Alignment Tools | Fairchild Type 7013 Tool Kit |
| Pads | GR 6 db and GR 20 db |

Turn on the power and allow 30 minutes of warm-up time.

## 5-6. DC BAL ADJUSTMENT R9200 & R9202 (R9300 & R9302)

**NOTE**

Reference symbols in parenthesis refer to Channel B.

If the dc balance of the Type 76-02A Amplifier is not properly adjusted, the reference trace on the screen will be depositioned when the VARIABLE control is rotated. To properly adjust, proceed as follows:

1. Set MODE switch to A and Input Selector switch to GND.
2. Set VOLTS/DIV switch to 0.005 and VARIABLE control fully counterclockwise.
3. Set front-panel DC BAL control R9202 to center of range and position trace to center of screen.
4. Adjust Coarse DC BAL potentiometer R9200 for no depositioning of trace when adjusting VARIABLE control back and forth.
5. Trim up with front-panel DC BAL control.
6. When the adjustment is complete, check that front-panel DC BAL control is set to its electrical center by setting VARIABLE control to minimum and positioning trace to center of screen.
7. Turn front-panel DC BAL control to one end, then to the other end. The deflection from center of screen shall be the same within 20% at the opposite ends of the potentiometer.
8. Set MODE switch to B and repeat steps 1 through 7 for Channel B.

### 5-7. GAIN ADJ R9212 (R9312)

Whenever the Type 76-02A Amplifier is removed from the Main Frame and inserted in another, the front-panel screwdriver GAIN ADJ control must be reset. To properly normalize the gain between channels or between the Plug-in unit and the Main Frame, proceed as follows:

1. Set both Channels A and B VOLTS/DIV switches to CAL and turn both VARIABLE controls fully clockwise to CAL.
2. Set MODE switch to CH A.
3. Adjust the sweep controls for a stable display.
4. Set Channel A front-panel screwdriver GAIN ADJ control for precisely 4 divisions of deflection.
5. Set MODE switch to ALT and adjust sweep rate for 2 msec/div.
6. Position the traces one on top of the other.
7. Adjust Channel A GAIN ADJ until only one trace may be observed (traces are superimposed).

### 5-8. TRIG DC LEVEL R9503

1. With no signal input, adjust the oscilloscope to obtain a trace centered on the screen.
2. Connect a voltmeter between pin 25 of P9001 and ground.
3. Adjust the TRIG DC LEVEL potentiometer R9503 for an indicated reading of zero volts.
4. Check that the beam position indicators operate properly.

### 5-9. HIGH-FREQUENCY ADJUSTMENTS C9209, C9211, C9406 & C9415 (C9309 & C9311)

1. Apply the output from a Fairchild Type 791A Square Wave Generator through a 50-ohm pad, then through a General Radio 10 or 20-db pad as required, and finally through a 50-ohm cable to Y Input terminated in 50 ohms.
2. Set Input Selector switch to NORM AC, VOLTS/DIV switch to 0.05, VARIABLE control to CAL, and MODE switch to A.
3. Set frequency range of Square Wave Generator to 500 Kc and adjust its output to give 4 divisions of vertical deflection.
4. Adjust the four trimmer capacitors C9209, C9211, C9406 and C9415 for the best flat-top square wave; ignore the bottom portion of this waveform.
5. Check the response in the 0.02, 0.01 and 0.005 VOLTS/DIV ranges.
6. Repeat steps 1 through 5 for Channel B.

*Note:* Do not reset trimmers C9406 and C9415 unless it is necessary. If these trimmers do have to be readjusted, work back and forth between Channels A and B until the best compromise is obtained. This completes the adjustments unless the Type 7001 Delay Line has been installed. If this be the case, proceed to step 7.

7. When the aforementioned adjustments have been made, a small step or notch of about 0.4 microsecond from the start of the trace may be noticed. This step is due to misalignment of the Type 7001 Delay Line termination. To minimize this notch, proceed as follows:

   a. Interchange the position of the X and Y Plug-in units. When these units are interchanged, the DELAY LINE TERM ADJ potentiometer R3 will now be accessible.

   b. Adjust this potentiometer R3 to minimize the notch at 0.4 microsecond from the start of the trace.

   c. Restore the plug-ins to their normal positions and slightly retouch the 4 trimmers of the preceding paragraph.

   d. The permissible overshoot should be less than 0.3 division out of 5 divisions. The termination bump should be less than 2 line widths.

### 5-10. INPUT CAPACITANCE STANDARDIZATION AND ATTENUATOR ADJUSTMENT (Figures 5-2 and 5-3)

The attenuators are factory aligned and should not be touched unless there is positive indication that they require adjustment. To make these adjustments, the front panel must be removed to gain access to the trimmer capacity. If adjustment is necessary, follow the steps as outlined making reference to Table 5-1. Reference symbols in ( ) pertain to Channel B.

The input capacitance standardization and attenuator adjustments are interdependent, therefore both tests must be performed in the same procedure. The need for readjustment is normally indicated by distortion of fast-rising waveforms on one or more of the most sensitive ranges of this plug-in unit.

Standardization of the input capacitance of this Y Plug-in unit requires the use of a 40-picofarad Capacitance Standardizer. To properly adjust the input capacitance and the attenuators of this plug-in unit, proceed as follows:

1. Interchange the X and Y Plug-ins. This procedure is required to gain access to the trimmers.
2. Adjust the trimmer of the Type 7012 Capacitance Standardizer to give 40 pf with a capacitance meter. If this meter is not available, set C9201 (C9301) to mid-range and adjust the trimmer of the Type 7012A instead of C9201 (C9301) when doing step 7.
3. Connect the Type 7012A directly to Channel A Input BNC connector on the Type 76-02A Plug-in.
4. Set the VOLTS/DIV switch to 0.05 and the Input Selector switch to NORM DC.
5. Apply the output from a Fairchild Type 791A Square Wave Generator through an RG-8A/U 50-ohm cable terminated in 50 ohms, through the 40-picofarad Capacitance Standardizer to the Input connector on the Type 76-02A. See Figure 5-2.

6. Set the Square Wave Generator to a 5 Kc and adjust the Time Base controls for a display of several cycles.

*Note:* Always center the square wave display on the cathode-ray tube screen. (Screen and square wave centers should agree within ±1 division or less.)

7. Adjust input trimmer C9201 (C9301) for flat-topped square waves (±0.2 div). Note comment in step 2 of this paragraph. See Figure 5-3.

8. Disconnect the 40-picofarad Capacitance Standardizer from the setup and connect the Type 7093 5:1 attenuator pad to the input BNC connector on the Type 76-02A.

9. Set Square Wave Generator to obtain 4 divisions of deflection and adjust the trimmer indicated in Table 5-1 for flat-topped response.

10. When adjustments are completed, restore the Plug-ins to their normal positions.

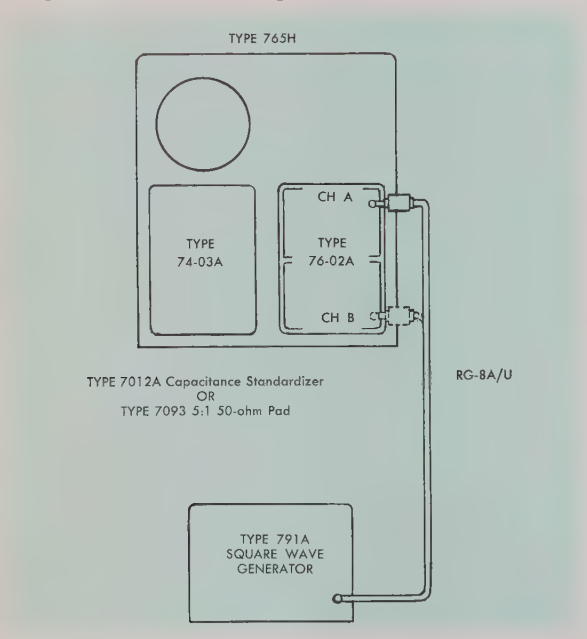



***Figure 5-2. Test Setup for Adjusting Input Capacitance***

**TABLE 5-1**

**ATTENUATOR COMPENSATION TRIMMERS**

| VOLTS/DIV Setting | Adjust Trimmers for Flat Top |
|---|---|
| 0.1 | C9102 (C9902) |
| 0.2 | C9104 (C9904) |
| 0.5 | C9106 (C9906) |
| 5.0 | C9108 (C9908) |
| 1.0 | C9105 (C9905) |
| 10 | C9107 (C9907) |

Disconnect the 50-ohm termination and reconnect the Capacitance Standardizer in the circuit. Continue the adjustments given below.

| VOLTS/DIV Setting | Adjust Trimmers for Flat Top |
|---|---|
| 0.1 | C9101 (C9901) |
| 0.2 | C9103 (C9903) |

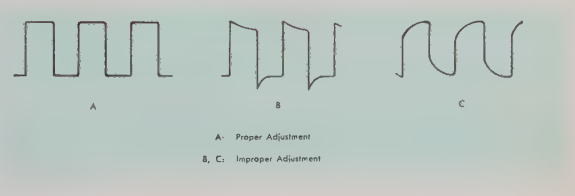



***Figure 5-3. Standardizing the Input Capacitance***

### 5-11. SET ATTENUATOR BALANCE R9234R (R9334R)

1. Vary VOLTS/DIV switch from 0.005 to 0.01.

2. Adjust ATTEN BAL potentiometer R9234R until there is no depositioning of the trace when switching the VOLTS/DIV switch back and forth.

3. Check the 20 and 50 millivolt ranges; readjust if necessary.

4. Repeat steps 1, 2, and 3 for Channel B.

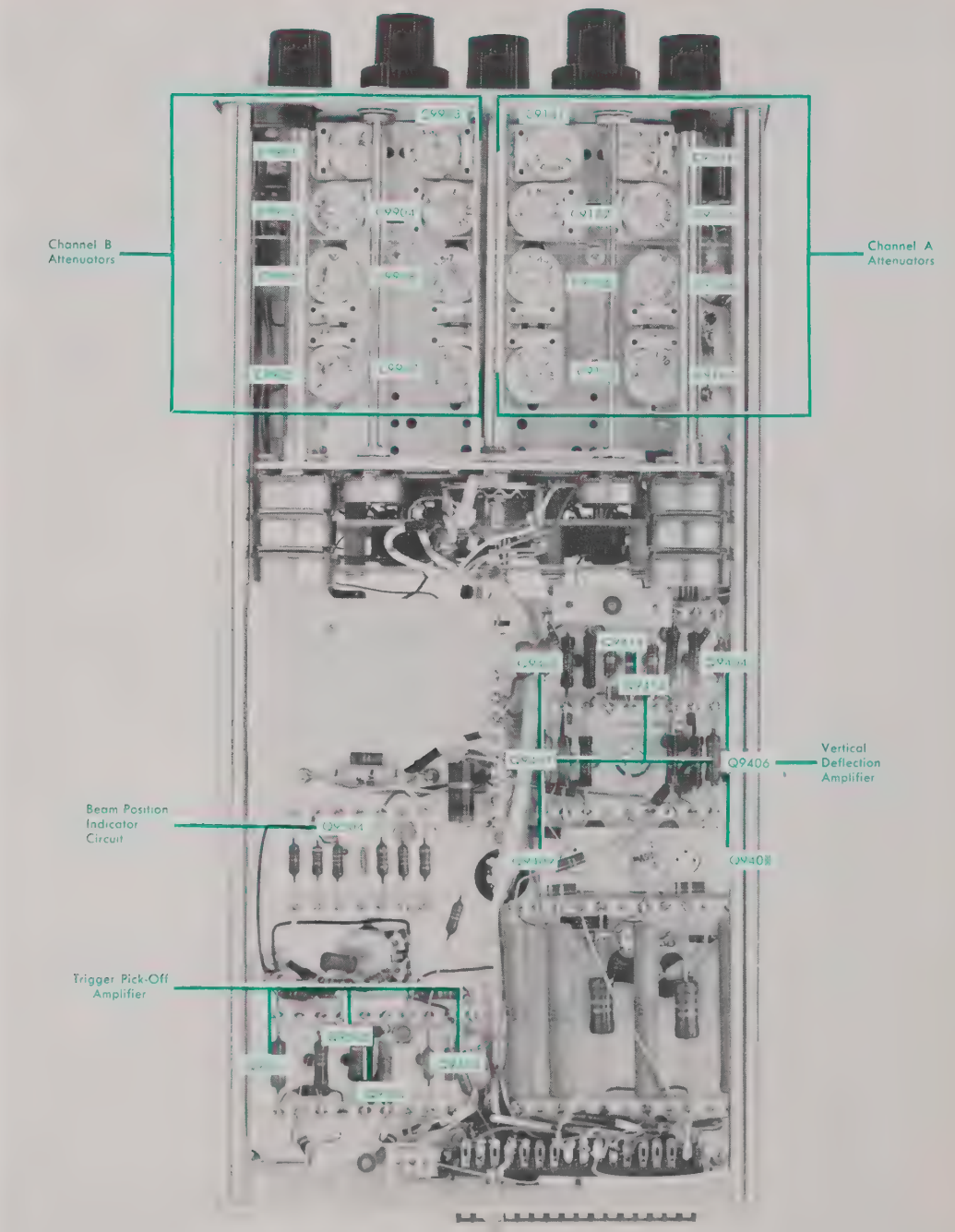



*Figure 5-4. Right Side View Showing Transistors and Attenuator Trimmers*

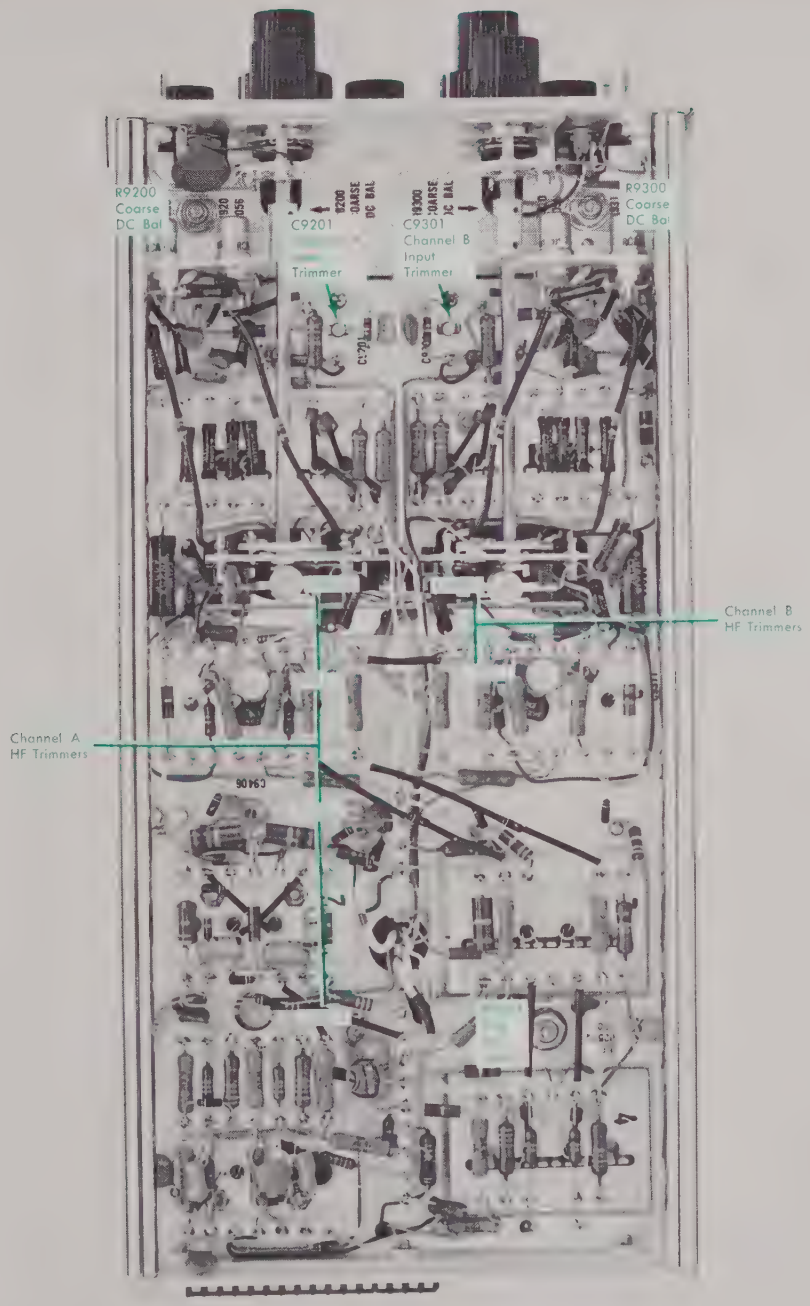



*Figure 5-5a. Left Side View Showing Pots and Trimmer Adjustments*

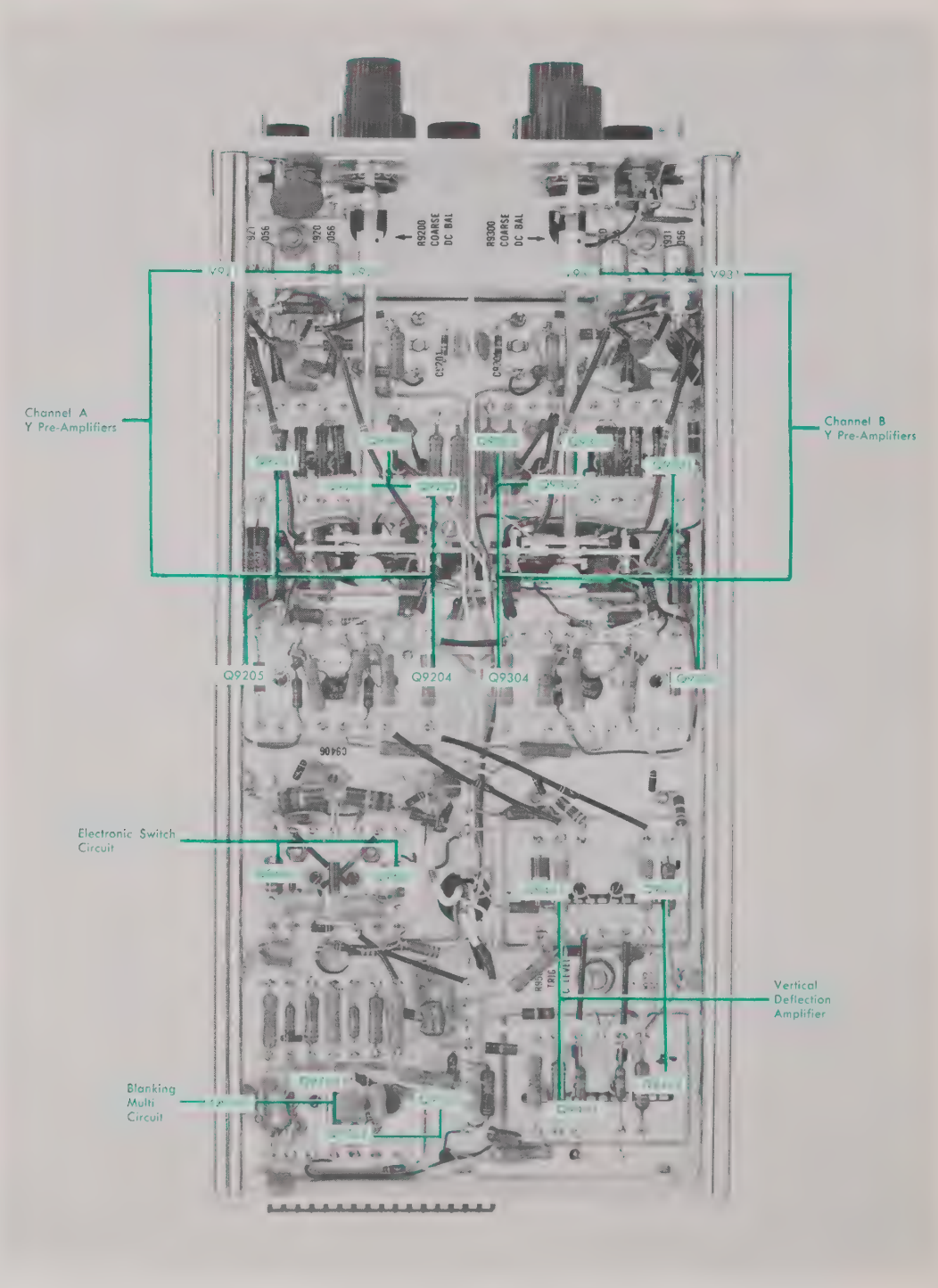



*Figure 5-5b. Left Side View Showing Transistors and Nuvistors*

NOTES

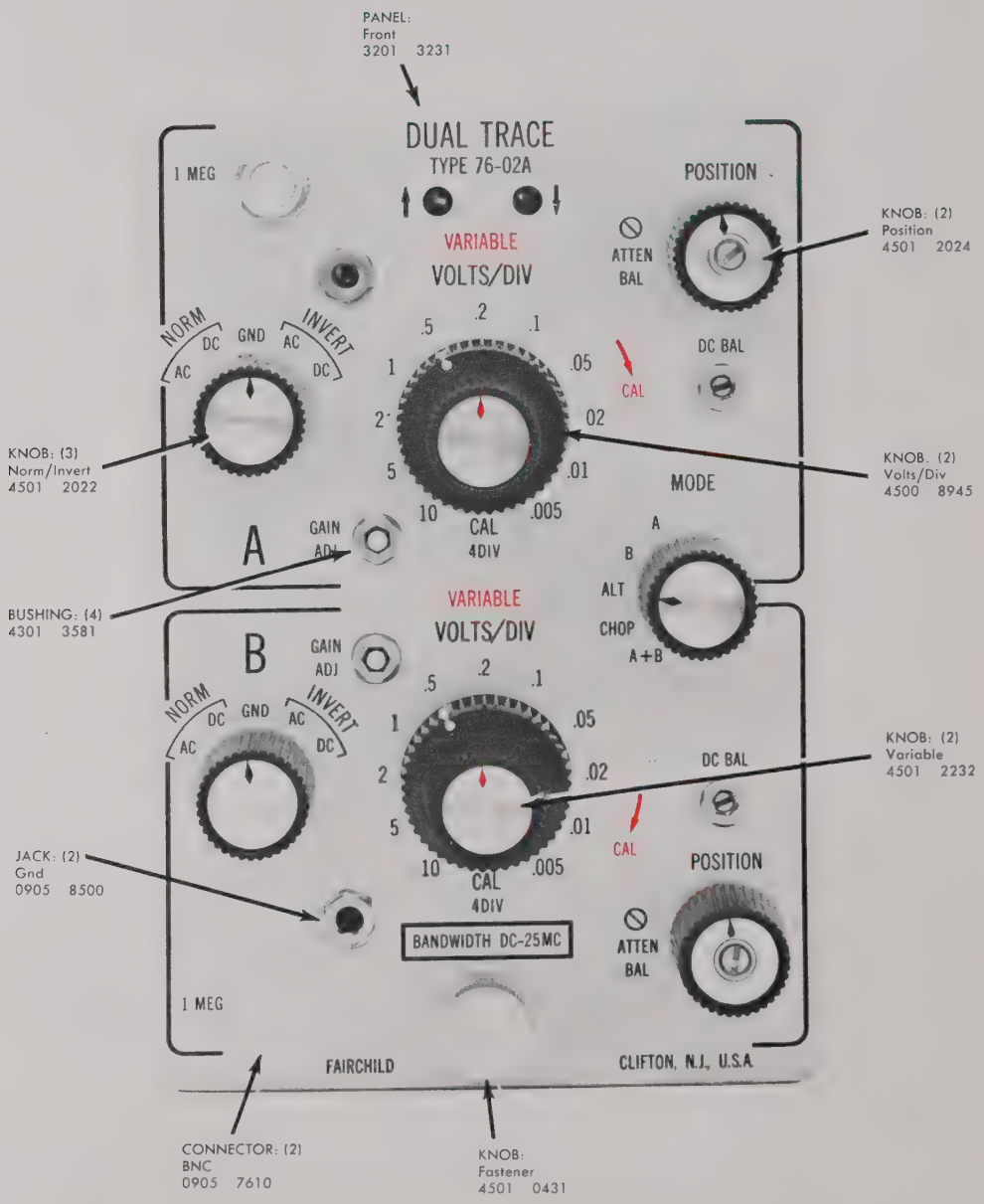



*Figure 6-1. Front Panel Replaceable Parts*

# SECTION 6A
# PARTS LISTS AND SCHEMATICS

## TYPE 76-02A DUAL TRACE PLUG-IN

### CAPACITORS

Notes: 1. All capacitors are fixed, ceramic, and 500V unless otherwise specified; pf denotes picofarads.

2. GMV denotes Guaranteed Minimum Value.

| Symbol | Part Number | Description | Recommended Vendor Code | Type |
|---|---|---|---|---|
| C9101 | 0300 3040 | variable, 3-12 pf | ERC | TS2A-3 |
| C9102 & C9103 | 0326 8650 | variable, 4-30 pf | ERC | TS2A |
| C9104 | 0300 3040 | variable, 3-12 pf | ERC | TS2A-3 |
| C9105 | 0326 8650 | variable, 4-30 pf | ERC | TS2A |
| C9106 | 0300 7790 | variable, 1.5-7 pf | ERC | NPO-TS2A |
| C9107 | 0326 8650 | variable, 4-30 pf | ERC | TS2A |
| C9108 | 0300 7790 | variable, 1.5-7 pf | ERC | NPO-TS2A |
| C9109 | 0315 4110 | 56 pf, ±5% | EIA | |
| C9111 | 0316 0270 | 22 pf, ±5% | EIA | |
| C9112 | 0316 0530 | 30 pf, ±5% | ERC | |
| C9113 | 0326 8700 | mica, 250 pf, ±10% | ERC | 625-003 |
| C9114 | 0317 5170 | mica, 39 pf, ±5% | EMC | DM15 |
| C9115 | 0327 2380 | plastic, 0.022 μf, 600V | GDE | 663 μw |
| C9116 | 0317 5170 | mica, 39 pf, ±5% | EMC | DM15 |
| C9117 | 0317 3840 | 330 pf, ±10% | EIA | |
| C9200 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM |
| C9201 | 0319 1281 | variable, 0.7-3 pf | ABD | |
| C9202 & C9203 | 0319 1060 | 0.01 μf, +60 —40%, 150V | CRL | DDM |
| C9205 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM |
| C9206 | 0315 2190 | 68 pf, ±10% | ERC | NPO811-680 |
| C9207 | 0315 4020 | 5.1 pf, ±0.5 pf | EIA | |
| C9208 | 0314 2690 | 91 pf, ±5% | ERC | GPI-331 |
| C9209 | 0326 9480 | variable, 9-35 pf, 100V | ERC | Style 538 |
| C9211 | 0326 9480 | variable, 9-35 pf, 100V | ERC | Style 538 |
| C9212 | 0317 5220 | mica, 56 pf, ±5% | EMC | DM-15 |
| C9213 | 0326 7860 | plastic, 0.1 μf, ±10%, 125V | AMX | C296AA |
| C9214 | 0319 1060 | 0.01 μf, +60 —40%, 150V | CRL | DDM |
| C9215 | 0313 3810 | composition, 0.68 pf, ±10% | STC | GA |
| C9217 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM |
| C9218 | 0326 7840 | plastic, 0.047 μf, ±10%, 125V | AMX | C296AA |
| C9219 | 0315 2190 | 68 pf, ±10% | ERC | NPO 811-680 |
| †C9220 C9221 | 0316 7220 | 5.6 pf, ±0.25 pf (Delay Line Option) | ERC | NPO-331 |
| C9300 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM |
| C9301 | 0319 1281 | variable, 0.7-3 pf | ABD | |
| C9302 & C9303 | 0319 1060 | 0.01 μf, +60 —40%, 150V | CRL | DDM |
| C9305 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM |
| C9306 | 0315 2190 | 68 pf, ±10% | ERC | NPO 811-680 |
| C9307 | 0315 4020 | 5.1 pf, ±0.5 pf | EIA | |
| C9308 | 0314 2690 | 91 pf, ±5% | ERC | GPI-331 |
| C9309 | 0326 9480 | variable, 9-35 pf, 100V | ERC | 538 |
| C9311 | 0326 9480, | variable, 9-35 pf, 100V | ERC | 538 |
| C9312 | 0317 5220 | mica, 56 pf, ±5% | EMC | DM15 |
| C9314 | 0319 1060 | 0.01 μf, +60 —40%, 150V | CRL | DDM103 |
| C9315 | 0313 3810 | composition, 0.68 pf, ±10% | STC | GA |
| C9317 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM |
| C9319 | 0315 2190 | 68 pf, ±10% | ERC | NPO-811-680 |
| †C9320 C9321 | 0316 7220 | 5.6 pf, ±0.25 pf (Delay Line Option) | ERC | NPO-331 |
| †C9400 C9401 & C9402 | 0319 1060 | 0.01 μf, +60 —40%, 150V | CRL | DDM103 |
| C9403 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM203 |
| C9404 | 0316 7370 | 15 pf | ERC | NPO-331 |
| C9405 | 0319 1060 | 0.01 μf, +60 —40%, 150V | CRL | DDM103 |
| C9406 | 0326 9480 | variable, 9-35 pf, 100V | ERC | 538 |
| C9407 | 0316 7280 | 10 pf, ±0.25 pf | ERC | NPO-331 |
| C9408 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM203 |
| C9409 | 0319 1060 | 0.01 μf, +60 —40%, 150V | CRL | DDM103 |
| C9410 | 0316 7280 | 10 pf, ±0.25 pf | ERC | NPO-331 |
| C9411 & C9412 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM203 |
| C9413 | 0319 1060 | 0.01 μf, +60 —40%, 150V | CRL | DDM103 |
| C9414 | 0316 7950 | 200 pf, ±20% | ERC | GP2K |
| C9415 | 0326 9480 | variable, 9-35 pf, 100V | ERC | 538 |
| C9416 | 0326 7860 | plastic, 0.1 μf, ±10%, 125V | AMX | C296AA |
| C9417 | 0316 7010 | 39 pf, ±5% | ERC | NPO-338 |
| C9418 | 0326 4520 | 1000 pf, GMV | ERC | |
| C9419 | 0317 5110 | mica, 22 pf, ±5% | EMC | DM15 |
| C9501 | 0316 7410 | 22 pf, ±5% | ERC | NPO-331 |
| C9502 | 0316 7280 | 10 pf, ±0.25 pf | ERC | NPO-331 |
| C9503 & C9504 | 0319 1060 | 0.01 μf, +60 —40%, 150V | CRL | DDM |
| C9505 & C9506 | 0310 1270 | 1000 pf, +100 —0%, 1000V | RMC | B |
| C9507 | 0319 1060 | 0.01 μf, +60 —40%, 150V | CRL | DDM103 |
| C9601 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM203 |
| C9602 | 0315 1530 | 33 pf, ±10% | ERC | NPO-338 |
| C9603 & C9604 | 0316 7050 | 51 pf, ±5% | ERC | NPO-338 |
| C9605 | 0315 1530 | 33 pf, ±10% | ERC | NPO-338 |
| C9606 | 0316 9440 | 470 pf, ±10%, 1000V | RMC | JL |
| C9607 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM |
| C9608 | 0317 5210 | Mica, 51 pf, ±5% | EMC | DM15 |
| C9701 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM 203 |
| C9702 | 0317 4250 | 820 pf, ±20%, 600V | CRL | No. D6-821 |
| C9703 | 0316 6560 | 220 pf, ±10% | ERC | GP2-331 |
| C9704 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM203 |
| C9705 | 0326 7860 | plastic, 0.1 μf, ±10%, 125V | AMX | C296AA |
| C9706 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM203 |
| C9707 | 0317 5350 | mica, 200 pf, ±5% | EMC | DM15 |
| C9708 | 0319 1050 | 0.02 μf, +60 —40%, 150V | CRL | DDM203 |
| C9709 | 0316 7280 | 10 pf, ±0.25 pf | ERC | NPO-331 |
| C9711 | 0319 1060 | 0.01 μf, +60 —40% 150V | CRL | DDM103 |
| C9801 to C9804 | 0310 1270 | 1000 pf, +100 —0%, 1000V | RMC | B |
| C9805 | 0326 7860 | plastic, 0.1 μf, ±10%, 125V | AMX | C296AA |
| C9901 | 0300 3040 | variable, 3-12 pf | ERC | TS2A-3 |
| C9902 & C9903 | 0326 8650 | variable, 4-30 pf | ERC | TS2A |
| C9904 | 0300 3040 | variable, 3-12 pf | ERC | TS2A-3 |
| C9905 | 0326 8650 | variable, 4-30 pf | ERC | TS2A |
| C9906 | 0300 7790 | variable, 1.5-7 pf | ERC | NPO-TS2A |
| C9907 | 0326 8650 | variable, 4-30 pf | ERC | TS2A |
| C9908 | 0300 7790 | variable, 1.5-7 pf | ERC | NPO-TS2A |
| C9909 | 0315 4110 | 56 pf, ±5% | EIA | |
| C9911 | 0316 0270 | 22 pf, ±5% | EIA | |
| C9912 | 0316 0350 | 30 pf, ±5% | ERC | |
| C9913 | 0326 8700 | mica, 250 pf, ±10% | ERC | 652-003 |
| C9914 | 0317 5170 | mica, 39 pf, ±5% | EMC | DM15 |
| C9915 | 0327 2380 | plastic, 0.022 μf, 600V | GDE | 663 μw |
| C9916 | 0317 5170 | mica, 39 pf, ±5% | EMC | DM15 |
| C9917 | 0317 3840 | 330 pf, ±10% | EIA | |

† C9220 or C9320 or C9400 depending on Mfr. Test option.

| Part Number | Description | Vendor |
|---|---|---|
| 0315 3500 | 12 pf, ±10% | EIA |
| 0315 3510 | 15 pf, ±10% | EIA |
| 0315 3520 | 18 pf, ±10% | EIA |
| 0315 3530 | 22 pf, ±10% | EIA |
| 0315 3540 | 27 pf, ±10% | EIA |
| 0315 3550 | 33 pf, ±10% | EIA |

### DELAY LINE

| | | | |
|---|---|---|---|
| ..... | *8901 6791 | Type 7001 | ABD |

* Depending on Sales order.

| Symbol | Part Number | Description | Recommended Vendor Code | Type |
|---|---|---|---|---|
| **SEMICONDUCTORS** | | | | |
| CR9200 to CR9203 | 2600 6910 | diode, FD841 | FCI | |
| CR9300 to CR9303 | 2600 6910 | diode, FD841 | FCI | |
| CR9601 to CR9605 | 2600 6910 | diode, FD841 | FCI | |
| CR9701 & CR9702 | 2600 6910 | diode, FD841 | FCI | |
| CR9704 | 2600 6910 | diode, FD841 | FCI | |
| CR9707 & CR9708 | 2600 6910 | diode, FD841 | FCI | |
| **LAMPS** | | | | |
| DS9501 & DS9502 | 1201 2350 | neon, 0.5 milliampere, 52-59 volts dc | SIG | T2 27 1R100 |
| **HYBRID COILS** | | | | |
| HY9202 to HY9205 | 2110 1560 | Bead, ferrite | FER | 56-590-65/3B |
| HY9302 to HY9305 | 2110 1560 | Bead, ferrite | FER | 56-590-65/3B |
| HY9400 to HY9407 | 2110 1560 | Bead, ferrite | FER | 56-590-65/3B |
| HY9501 & HY9502 | 2110 1560 | Bead, ferrite | FER | 56-590-65/3B |
| **ELECTRICAL CONNECTORS** | | | | |
| J9101 | 0905 7610 | receptacle, rf, female, 1 contact, BNC, UG-625A/U | DAG | |
| J9103 | 0905 8500 | jack, assembly | AMA | Part #403 |
| J9901 | 0905 7610 | receptacle, rf, female, 1 contact, BNC, UG-625A/U | DAG | |
| J9903 | 0905 8500 | jack, assembly | AMA | Part #403 |
| P9001 | 0905 7340 | plug, male, 32 contacts | APH | 26-159-32 |
| **TRANSISTORS** | | | | |
| Q9200 | 2600 7700 | DU #12A | FCI | |
| & Q9201 | 2600 7680 | alternate 2N709 | | |
| Q9202 to Q9205 | 2600 2771 | DU #2N | ABD | |
| | 2600 7050 | alternate 2N915 | | |
| Q9300 | 2600 7700 | DU #12A | FCI | |
| & Q9301 | 2600 7680 | alternate 2N709 | | |
| Q9302 to Q9305 | 2600 2771 | DU #2N | ABD | |
| | 2600 7050 | alternate 2N915 | | |
| Q9400 | 2600 7060 | DU #2 | FCI | |
| & Q9401 | 2600 7050 | alternate 2N915 | | |
| Q9402 | 2600 7020 | DU #1A | FCI | |
| & Q9403 | 2600 7000 | alternate 2N914 | | |
| Q9404 | 2600 7060 | DU #2 | FCI | |
| & Q9405 | 2600 7050 | alternate 2N915 | | |
| Q9406 | 2600 7020 | DU #1A | FCI | |
| & Q9407 | 2600 7000 | alternate 2N914 | | |
| Q9408 & Q9409 | 2600 2791 | 2N2218 (Selected) | FCI | |
| Q9413 | 2600 7070 | DU #2A | FCI | |
| & Q9414 | 2600 7050 | alternate 2N915 | | |
| Q9501 to Q9503 | 2600 7070 | DU #2A | FCI | |
| | 2600 7050 | alternate 2N915 | | |
| Q9504 | 2600 7370 | 8A/2N699B | FCI | |
| Q9505 | 2600 7070 | DU #2A | FCI | |
| | 2600 7050 | alternate 2N915 | | |
| Q9600 | 2600 7020 | DU #1A | FCI | |
| & Q9601 | 2600 7000 | alternate 2N914 | | |
| Q9701 | 2600 7020 | DU #1A | FCI | |
| & Q9702 | 2600 7000 | alternate 2N914 | | |
| Q9703 | 2600 7160 | DU #4 | FCI | |
| | 2600 7150 | alternate 2N1132 | | |
| Q9704 | 2600 7070 | DU #2A | FCI | |
| | 2600 7050 | alternate 2N915 | | |

| Symbol | Part Number | Description | Recommended Vendor Code | Type |
|---|---|---|---|---|
| **RESISTORS** | | | | |
| Note: All resistors are fixed, film, ±5%, ½W and values in ohms unless otherwise specified. K = thousand, M = million. | | | | |
| R9101 | 0229 4890 | 500K, ±1% | TEX | CD1/2PR |
| R9102 | 0229 4900 | 750K, ±1% | TEX | CD1/2PR |
| R9103 | 0229 4910 | 900K, ±1% | TEX | CD1/2PR |
| R9104 | 0229 9010 | 990K, ±1% | TEX | CD1/2PR |
| R9105 | 0235 0190 | 52.3, ±1%, ¼W | TEX | CD1/4PR |
| R9106 | 0229 4700 | 1M, ±1% | TEX | CD1/2PR |
| R9107 | 0229 9040 | 333K, ±1% | TEX | CD1/2PR |
| R9108 | 0229 9050 | 111K, ±1% | TEX | CD1/2PR |
| R9109 | 0229 9080 | 10.1K, ±1% | TEX | CD1/2PR |
| R9111 | 0235 0140 | 105, ±1%, ¼W | TEX | CD1/4R |
| R9112 | 0235 0180 | 42.2, ±1%, ¼W | TEX | CD1/4R |
| R9113 | 0235 0190 | 52.3, ±1%, ¼W | TEX | CD1/4R |
| R9114 | 0235 0140 | 105, ±1%, ¼W | TEX | CD1/4R |
| R9115 | 0203 0000 | composition, 10 | ALB | EB |
| R9116 | 0236 7830 | 174K, ±1% | CGW | N20 |
| R9117 | 0229 9290 | 590K, ±1% | TEX | CD1/2PR |
| R9118 & R9119 | 0237 1800 | 31.6, ±1%, ¼W | TEX | CD1/4R |
| R9121 & R9122 | 0203 0040 | composition, 15 | ALB | EB |
| R9123 & R9124 | 0235 4450 | composition, 200, ¼W | ALB | CB |
| R9126 | 0235 4180 | composition, 15, ¼W | ALB | CB |
| R9127 | 0235 4320 | composition, 56, ¼W | ALB | CB |
| R9200 | 0107 4380 | variable, composition, 100K, ±20%, .2W (COARSE DC BAL) | CTS | Series 70 |
| R9201 | 0229 4700 | 1M, ±1% | TEX | CD1/2PR |
| R9202 | 0109 2050 | variable, composition, 100K, ±20%, .2W (FINE DC BAL) | CTS | Series 70 |
| R9203 | 0203 1360 | composition, 4.7M | ALB | EB |
| R9204 | 0234 8430 | 8.2K | CGW | C-20 |
| R9205 | 0203 1610 | composition, 47, ±10% | ALB | EB |
| R9206 | 0235 5090 | composition, 100K, ¼W | ALB | CB |
| R9207 | 0235 6590 | composition, 100, ±20%, ¼W | ALB | CB |
| R9208 | 0236 6750 | 13K, ±1% | CGW | N-20 |
| R9209 | 0235 6590 | composition, 100, ±20%, ¼W | ALB | CB |
| R9210 | 0236 3180 | 470K | CGW | C-20 |
| R9211 | 0236 6750 | 13K, ±1% | CGW | N-20 |
| R9212 | 0107 2657 | variable, composition, 10K, ±20%, ¼W (GAIN CAL) | ABD | |
| R9213 | 0107 2842 | variable, composition, 1.5K, ±20%, ¼W (VARIABLE) | ABD | |
| R9214 | 0236 5720 | 1.1K, ±1% | CGW | N-20 |
| R9215 | 0237 1700 | 6.98K, ±1%, 1W | CGW | N-25 |
| R9216 | 0236 5720 | 1.1K, ±1% | CGW | N-20 |
| R9217 | 0203 1610 | composition, 47, ±10% | ALB | EB |
| R9218 & R9219 | 0236 5980 | 2.05K, ±1% | CGW | N-20 |
| R9220 & R9221 | 0236 5810 | 1.37K, ±1% | CGW | N-20 |
| R9222 | 0236 6930 | 20K, ±1% | CGW | N-20 |
| R9223 | 0235 4240 | composition, 27, ¼W | ALB | CB |
| R9224 | 0236 6930 | 20K, ±1% | CGW | N-20 |
| R9225 | 0235 4240 | composition, 27, ¼W | ALB | CB |
| R9226 | 0203 0160 | composition, 47 (GAIN ADJ) | ALB | EB |
| R9227 & R9228 | 0236 5010 | 200, ±1% | CGW | C-20 |
| R9230 | 0234 9030 | 820, 1W | CGW | C-32 |
| R9233 | 0236 3090 | 200K | CGW | C-20 |
| R9234 F/C/R | 0107 2801 | variable, composition, 100K/100K/1K, ±20% (POSITION/ATTEN BAL) | ABD | |
| R9236 | 0236 3090 | 200K | CGW | C-20 |
| R9237 & R9238 | 0234 9260 | 7.5K, 1W | CGW | C-32 |
| R9241 | 0235 4900 | composition, 16K, ¼W (Delay Line Option) | ALB | CB |
| R9242 | 0235 9650 | 2.74K, ±1% | CGW | NI-20 |
| R9243 & R9244 | 0235 8500 | 221, ±1% | CGW | NI-20 |
| R9245 | 0235 5070 | composition, 82K, ¼W | ALB | CB |
| R9246 | 0235 9650 | 2.74K, ±1% | CGW | NI-20 |

| Symbol | Part Number | Description | Recommended Vendor Code | Type |
|---|---|---|---|---|
| R9247 | 0236 0520 | 17.4K, ±1% | CGW | NI-20 |
| R9248 | 0235 9500 | 2K, ±1% | CGW | NI-20 |
| R9249 | 0203 2400 | composition, 470, ±20% | ALB | EB |
| R9250 | 0235 5810 | composition, 47, ±10%, ¼W | ALB | CB |
| R9251 | 0235 5780 | composition, 27, ±10%, ¼W | ALB | CB |
| R9252 | 0235 5810 | composition, 47, ±10%, ¼W | ALB | CB |
| R9253 | 0235 5780 | composition, 27, ±10%, ¼W | ALB | CB |
| R9254 | 0234 9640 | 300K, 1W | CGW | C-32 |
| R9255 & R9256 | 0203 2190 | composition, 3.3M, ±10% | ALB | EB |
| R9257 | 0234 9640 | 300K, 1W | CGW | C-32 |
| R9258 & R9259 | 0236 1620 | 200K, ±1% | CGW | NI-20 |
| R9260 | 0236 3110 | 240K | CGW | C-20 |
| R9261 | 0203 1480 | composition, 15M | ALB | EB |
| R9300 | 0107 4380 | variable, composition, 100K, ±20%, .2W (COARSE DC BAL) | CTS | Series 70 |
| R9301 | 0229 4700 | 1M, ±1% | TEX | CD1/2PR |
| R9302 | 0109 2050 | variable, composition, 100K, ±20%, .2W (FINE DC BAL) | CTS | Series 70 |
| R9303 | 0203 1360 | composition, 4.7M | ALB | EB |
| R9304 | 0234 8430 | 8.2K | CGW | C-20 |
| R9305 | 0203 1610 | composition, 47, ±10% | ALB | EB |
| R9306 | 0235 5090 | composition, 100K, ¼W | ALB | CB |
| R9307 | 0235 6590 | 100, ±20%, ¼W | ALB | CB |
| R9308 | 0236 6750 | 13K, ±1% | CGW | N-20 |
| R9309 | 0235 6590 | composition, 100, ±20%, ¼W | ALB | CB |
| R9310 | 0236 3180 | 470K | CGW | C-20 |
| R9311 | 0236 6750 | 13K, ±1% | CGW | N-20 |
| R9312 | 0107 2657 | variable, composition, 10K, ±20%, ¼W (GAIN CAL) | ABD | |
| R9313 | 0107 2842 | variable, composition, 1.5K, ±20%, ¼W (VARIABLE | ABD | |
| R9314 | 0236 5720 | 1.1K, ±1% | CGW | N-20 |
| R9315 | 0237 1700 | 6.98K, ±1%, 1W | CGW | N-25 |
| R9316 | 0236 5720 | 1.1K, ±1% | CGW | N-20 |
| R9317 | 0203 1610 | composition, 47, ±10% | ALB | EB |
| R9318 & R9319 | 0236 5980 | 2.05K, ±1% | CGW | N-20 |
| R9320 & R9321 | 0236 5810 | 1.37K, ±1% | CGW | N-20 |
| R9322 | 0236 6930 | 20K, ±1% | CGW | N-20 |
| R9323 | 0235 4240 | composition, 27, ¼W | ALB | CB |
| R9324 | 0236 6930 | 20K, ±1% | CGW | N-20 |
| R9325 | 0235 4240 | composition, 27, ¼W | ALB | CB |
| R9326 | 0203 0160 | composition, 47 | ALB | EB |
| R9327 & R9328 | 0236 5010 | 200, ±1% | CGW | N-20 |
| R9330 | 0234 9030 | 820, 1W | CGW | C-32 |
| R9333 | 0236 3090 | 200K | CGW | C-20 |
| R9334 F/C/R | 0107 2801 | variable, composition, 100K/ 100K/1K, ±20% (POSITION/ ATTEN BAL) | ABD | |
| R9336 | 0236 3090 | 200K | CGW | C-20 |
| R9337 & R9338 | 0234 9260 | 7.5K, 1W | CGW | C-32 |
| R9341 | 0235 4900 | composition, 16K, ¼W (Delay Line Option) | ALB | CB |
| R9343 & R9344 | 0235 8500 | 221, ±1% | CGW | NI-20 |
| R9345 | 0235 5070 | 82K, ¼W | ALB | CB |
| R9347 | 0236 0520 | 17.4K, ±1% | CGW | NI-20 |
| R9350 | 0235 5810 | composition, 47 ±10%, ¼W | ALB | CB |
| R9351 | 0235 5780 | composition, 27, ±10%, ¼W | ALB | CB |
| R9352 | 0235 5810 | composition, 47, ±10%, ¼W | ALB | CB |
| R9353 | 0235 5780 | composition, 27, ±10%, ¼W | ALB | CB |
| R9358 & R9359 | 0236 1620 | 200K, ±1% | CGW | NI-20 |
| R9401 | 0203 1580 | composition, 27, ±10% | ALB | EB |
| R9402 | 0203 0300 | composition, 180 | ALB | EB |
| R9405 & R9406 | 0234 8450 | 10K | CGW | C-20 |
| R9407 & R9408 | 0203 0120 | composition, 33 | ALB | EB |
| R9409 | 0234 9150 | 2.7K, 1W | CGW | C-32 |
| R9410 | 0234 8450 | 10K, ±1% | CGW | C-20 |
| R9411 | 0234 9150 | 2.7K, 1W | CGW | C-32 |

| Symbol | Part Number | Description | Recommended Vendor Code | Type |
|---|---|---|---|---|
| R9412 | 0203 1580 | composition, 27, ±10% | ALB | EB |
| R9413 & R9414 | 0236 4760 | 110, ±1% | CGW | N-20 |
| R9415 | 0236 9590 | 1.1K, ±2%, 2W | CGW | C42F |
| R9416 | 0236 5980 | 2.05K, ±1% | CGW | N-20 |
| R9417 | 0236 6560 | 8.25K, ±1% | CGW | N-20 |
| R9418 | 0236 7070 | 28K, ±1% | CGW | N-20 |
| R9419 | 0234 8450 | 10K | CGW | C-20 |
| R9420 | 0203 1580 | composition, 27, ±10% | ALB | EB |
| R9421 | 0236 5210 | 324, ±1% | CGW | N-20 |
| R9422 | 0236 7070 | 28K, ±1% | CGW | N-20 |
| R9423 | 0236 5980 | 2.05K, ±1% | CGW | N-20 |
| R9424 | 0203 1580 | composition, 27, ±10% | ALB | EB |
| R9425 | 0236 6560 | 8.25K, ±1% | CGW | N-20 |
| R9426 | 0235 5730 | composition, 10, ±10%, ¼W | ALB | CB |
| R9427 & R9428 | 0235 2340 | 3.6K, ±2%, 1W | CGW | C-32 |
| R9429 | 0230 4170 | 768, ±1%, 4W | CGW | SI-30 |
| R9430 & R9431 | 0235 4300 | composition, 47, ¼W | ALB | CB |
| R9432 | 0237 1110 | 15K, 2W | CGW | C42S |
| R9433 | 0203 0580 | composition, 2.7K | ALB | EB |
| R9434 | 0230 4180 | 3.24K, ±1%, 4W | CGW | SI-30 |
| R9436 | 0236 5040 | 215, ±1% | CGW | NI-20 |
| R9437 | 0230 4180 | 3.24K, ±1%, 4W | CGW | SI-30 |
| R9438 | 0237 1110 | 15K, 2W | CGW | C42S |
| R9440 | 0203 1580 | composition, 27, ±10% | ALB | EB |
| R9441 | 0230 4170 | 768, ±1%, 4W | CGW | SI-30 |
| R9442 | 0235 5730 | composition, 10, ±10%, ¼W | ALB | CB |
| R9443 & R9444 | 0203 2190 | composition, 3.3M, ±10% | ALB | EB |
| R9445 | 0203 0760 | composition, 15K | ALB | EB |
| R9446 | 0234 8510 | 18K, ±1% | CGW | C-20 |
| R9447 | 0234 8560 | 30K, ±1% | CGW | C-20 |
| R9450 | 0235 4170 | composition, 13, ¼W | ALB | CB |
| R9501 | 0234 8120 | 430 | CGW | C-20 |
| R9502 | 0234 9350 | 18K, 1W | CGW | C-32 |
| R9503 | 0106 3360 | variable, composition, 25K, ±10% (TRIG DC LEVEL) | CTS | Series 65 |
| R9504 | 0234 9350 | 18K, 1W | CGW | C-32 |
| R9505 | 0234 8470 | 12K | CGW | C-20 |
| R9506 | 0236 7100 | 30.1K, ±1% | CGW | N-20 |
| R9507 | 0234 8540 | 24K | CGW | C-20 |
| R9508 | 0234 9110 | 1.8K, 1W | CGW | C-32 |
| R9509 | 0234 8280 | 2K | CGW | C-20 |
| R9510 | 0234 8470 | 12K | CGW | C-20 |
| R9511 | 0236 0270 | 10K, ±1% | CGW | NI-20 |
| R9512 | 0234 8400 | 6.2K | CGW | C-20 |
| R9513 | 0234 8540 | 24K | CGW | C-20 |
| R9514 | 0234 8280 | 2K | CGW | C-20 |
| R9515 | 0234 8360 | 4.3K | CGW | C-20 |
| R9516 | 0234 8660 | 75K | CGW | C-20 |
| R9517 | 0234 8540 | 24K | CGW | C-20 |
| R9518 | 0234 8520 | 20K | CGW | C-20 |
| R9519 | 0234 8550 | 27K | CGW | C-20 |
| R9520 | 0234 8600 | 43K | CGW | C-20 |
| R9521 | 0234 8660 | 75K | CGW | C-20 |
| R9522 | 0234 8430 | 8.2K | CGW | C-20 |
| R9601 | 0203 2300 | composition, 10, ±20% | ALB | EB |
| R9602 | 0203 3550 | composition, 2K, 1W | ALB | GB |
| R9603 | 0203 0630 | composition, 4.3K | ALB | EB |
| R9604 | 0235 4680 | composition, 2K, ¼W | ALB | CB |
| R9605 | 0203 0870 | composition, 43K | ALB | EB |
| R9606 | 0203 0760 | composition, 15K | ALB | EB |
| R9607 | 0203 0630 | composition, 4.3K | ALB | EB |
| R9608 | 0235 4680 | composition, 2K, ¼W | ALB | CB |
| R9609 | 0203 0870 | composition, 43K | ALB | EB |
| R9610 | 0203 0770 | composition, 16K | ALB | EB |
| R9611 | 0203 0760 | composition, 15K | ALB | EB |
| R9612 | 0203 3550 | composition, 2K, 1W | ALB | GB |
| R9613 | 0203 3580 | composition, 2.7K, 1W | ALB | GB |
| R9614 | 0203. 0390 | composition, 430 | ALB | EB |
| R9615 & R9616 | 0203 0740 | composition, 12K | ALB | EB |
| R9617 | 0203 3370 | composition, 360, 1W | ALB | EB |
| R9701 | 0236 0060 | 6.81K, ±1% | CGW | NI-20 |
| R9702 | 0234 9170 | 3.3K, 1W | CGW | C-32 |

| Symbol | Part Number | Description | Recommended Vendor Code | Type |
|---|---|---|---|---|
| R9703 | 0234 8430 | 8.2K | CGW | C-20 |
| R9704 | 0234 8630 | 56K | CGW | C-20 |
| R9705 | 0234 8570 | 33K | CGW | C-20 |
| R9706 | 0234 8630 | 56K | CGW | C-20 |
| R9707 | 0234 9170 | 3.3K, 1W | CGW | C-32 |
| R9708 | 0234 9110 | 1.8K, 1W | CGW | C-32 |
| R9709 | 0203 0070 | composition, 20 | ALB | EB |
| R9710 | 0235 4310 | composition, 51, ¼W | ALB | CB |
| R9711 | 0203 1530 | composition, 10, ±10% | ALB | EB |
| R9712 | 0235 9190 | 976, ±1% | CGW | NI-20 |
| R9713 | 0234 8430 | 8.2K | CGW | C-20 |
| R9714 | 0235 9970 | 5.62K, ±1% | CGW | NI-20 |
| R9715 | 0236 0470 | 15.8K, ±1% | CGW | NI-20 |
| R9716 | 0236 0510 | 16.9K, ±1% | CGW | NI-20 |
| R9717 | 0235 1580 | 8.45K, ±1% | CGW | NI-20 |
| R9718 | 0234 8340 | 3.6K | CGW | C-20 |
| R9719 | 0235 9600 | 2.49K, ±1% | CGW | NI-20 |
| R9720 | 0203 0530 | composition, 1.6K | ALB | EB |
| R9721 | 0236 0690 | 24.9K, ±1% | CGW | NI-20 |
| R9722 | 0234 8370 | 4.7K | CGW | C-20 |
| R9801 & R9802 | 0239 1359 | 430, 2W | CGW | C-42 |
| R9803 | 0203 0070 | composition, 20 | ALB | EB |
| R9804 | 0234 8260 | 1.6K | CGW | C-20 |
| R9901 | 0229 4890 | 500K, ±1% | TEX | CD1/2PR |
| R9902 | 0229 4900 | 750K, ±1% | TEX | CD1/2PR |
| R9903 | 0229 4910 | 900K, ±1% | TEX | CD1/2PR |
| R9904 | 0229 9010 | 990K, ±1% | TEX | CD1/2PR |
| R9905 | 0235 0190 | 52.3, ±1%, ¼W | TEX | CD1/4R |
| R9906 | 0229 4700 | 1M, ±1% | TEX | CD1/2PR |
| R9907 | 0229 9040 | 333K, ±1% | TEX | CD1/2PR |
| R9908 | 0229 9050 | 111K, ±1% | TEX | CD1/2PR |
| R9909 | 0229 9080 | 10.1K, ±1% | TEX | CD1/2PR |
| R9911 | 0235 0140 | 105, ±1%, ¼W | TEX | CD1/4R |
| R9912 | 0235 0180 | 42.2, ±1%, ¼W | TEX | CD1/4R |
| R9913 | 0235 0190 | 52.3, ±1%, ¼W | TEX | CD1/4R |
| R9914 | 0235 0140 | 105, ±1%, ¼W | TEX | CD1/4R |
| R9915 | 0203 0000 | composition, 10 | ALB | EB |
| R9916 | 0236 7830 | 174K, ±1% | CGW | N-20 |
| R9917 | 0229 9290 | 590K, ±1% | TEX | CD1/2PR |
| R9918 & R9919 | 0237 1800 | 31.6, ±1%, ¼W | TEX | CD1 4R |
| R9921 & R9922 | 0203 0040 | composition, 15 | ALB | EB |
| R9923 & R9924 | 0235 4550 | composition, 200, ¼W | ALB | CB |
| R9926 | 0235 4180 | composition, 15, ¼W | ALB | CB |
| R9927 | 0235 4320 | composition, 56, ¼W | ALB | CB |

## SWITCHES

| | | | |
|---|---|---|---|
| S910 | 0501 7212 | rotary, 6 sections, 12 positions (VOLTS DIV) | ABD |
| S911 | 0501 7152 | slide, 1 section, 5 positions (AC/DC/GND) | ABD |
| S920 | 0501 7221 | rotary, push-push (INVERT) | ABD |
| S930 | 0501 7221 | rotary, push-push (INVERT) | ABD |
| S960 | 0501 6831 | rotary, 1 section, 5 positions (MODE) | ABD |
| S990 | 0501 7212 | rotary, 6 sections, 12 positions (VOLTS/DIV) | ABD |
| S991 | 0501 7152 | slide, 1 section, 3 positions (AC/DC/GND) | ABD |

## ELECTRON TUBES

| | | | | |
|---|---|---|---|---|
| V920 & V921 | 2501 4060 | 8056 | RCA | Nuvistor |
| V930 & V931 | 2501 4060 | 8056 | RCA | Nuvistor |

## NETWORKS

| | | | | |
|---|---|---|---|---|
| Z9401 & Z9402 | 8800 2422 | peaking | ABD | |
| Type 7001 Delay Line | 8901 6791 | | ABD | |

## NOTES

# SECTION 6B
# SPARE PARTS LIST

## SPARE PARTS REQUIREMENTS

### a. General

The Type 76-02A Dual Trace Plug-in is an extremely reliable and dependable instrument. Only components thoroughly tested and approved by the engineers of the Quality Assurance Laboratory are used in this instrument. Continued performance tests, environmental and life testing of production units make certain your oscilloscope will give many years of satisfactory service. These new Fairchild oscilloscopes are precision engineered and require no selected parts.

Two lists of "running spares" are included to aid you in periodic maintenance. The running-spare parts lists include recommended quantities and reference symbol numbers. Section 6A of this Instruction Manual gives a complete listing of all components and their recommended vendors so that you may readily procure them from a local supply house or your own stores.

*Note:* The local Fairchild Scientific Instrument Field Engineering representative and his service organization can assist you in obtaining any additional components in the shortest possible time. To help expedite service, always give the Type Number and Serial Number of the instrument; always specify the part number and give a description of the component (see Section 6A of this manual).

### b. 500-Hour Spares (6 months)

The recommended list for one through three units follows.

#### Electron Tubes

| Symbol | Quantity |
|---|---|
| V920 | 2 |

#### Transistors

| | |
|---|---|
| Q9200 | 2 |
| Q9202 | 4 |
| Q9400 | 2 |
| Q9406 | 4 |
| Q9408 | 1 |
| Q9413 | 3 |
| Q9504 | 1 |
| Q9703 | 1 |

#### Diodes

| | |
|---|---|
| CR9200 (FD841) | 8 |

#### Lamps

| | |
|---|---|
| DS9501 | 1 |

### c. 2000-Hour Spares (2 years)

The recommended list for one through five units is given below. Maintain spares indicated plus one for each oscilloscope in use; 2 of each set of the 500-hour spare list given in paragraph (b) plus the quantities listed as follows:

#### Capacitors

| Symbol | Quantity | Symbol | Quantity |
|---|---|---|---|
| C9101 | 3 | C9215 | 1 |
| C9102 | 3 | C9218 | 1 |
| C9106 | 2 | C9220 | 1 |
| C9109 | 1 | C9221 | 1 |
| C9111 | 1 | C9320 | 1 |
| C9112 | 1 | C9400 | 1 |
| C9113 | 1 | C9407 | 2 |
| C9114 | 2 | C9414 | 1 |
| C9115 | 1 | C9417 | 1 |
| C9117 | 1 | C9418 | 1 |
| C9200 | 8 | C9419 | 1 |
| C9102 | 1 | C9501 | 1 |
| C9202 | 7 | C9505 | 3 |
| C9206 | 2 | C9602 | 1 |
| C9207 | 1 | C9603 | 1 |
| C9208 | 1 | C9606 | 1 |
| C9209 | 3 | C9702 | 1 |
| C9212 | 1 | C9703 | 1 |
| C9213 | 2 | C9707 | 1 |

#### Lamps

| Symbol | Quantity |
|---|---|
| DS9501 | 1 |

#### Hybrid Coil

| | |
|---|---|
| HY9202 | 8 |

#### Electrical Connectors

| | |
|---|---|
| J9101 | 1 |
| J9103 | 1 |
| P9001 | 1 |

### Resistors

| Symbol | Quantity | Symbol | Quantity |
|---|---|---|---|
| R9101 | 1 | R9418 | 1 |
| R9102 | 1 | R9421 | 1 |
| R9103 | 1 | R9426 | 1 |
| R9104 | 1 | R9427 | 1 |
| R9105 | 2 | R9429 | 1 |
| R9106 | 3 | R9430 | 1 |
| R9107 | 1 | R9432 | 1 |
| R9108 | 1 | R9433 | 1 |
| R9109 | 1 | R9434 | 1 |
| R9111 | 2 | R9445 | 1 |
| R9112 | 1 | R9446 | 1 |
| R9115 | 1 | R9447 | 1 |
| R9116 | 1 | R9450 | 1 |
| R9117 | 1 | | |
| R9118 | 2 | | |
| R9121 | 2 | R9501 | 1 |
| R9123 | 2 | R9502 | 1 |
| R9126 | 1 | R9503 | 1 |
| R9127 | 1 | R9505 | 1 |
| | | R9506 | 1 |
| | | R9507 | 1 |
| R9200 | 1 | R9508 | 1 |
| R9202 | 1 | R9509 | 1 |
| R9203 | 1 | R9511 | 1 |
| R9204 | 2 | R9512 | 1 |
| R9205 | 3 | R9515 | 1 |
| R9206 | 1 | R9516 | 1 |
| R9207 | 2 | R9518 | 1 |
| R9208 | 2 | R9519 | 1 |
| R9212 | 1 | R9520 | 1 |
| R9213 | 1 | | |
| R9214 | 2 | | |
| R9215 | 1 | R9601 | 1 |
| R9218 | 3 | R9602 | 1 |
| R9220 | 2 | R9603 | 1 |
| R9222 | 2 | R9604 | 1 |
| R9223 | 2 | R9605 | 1 |
| R9226 | 1 | R9610 | 1 |
| R9227 | 2 | R9613 | 1 |
| R9230 | 1 | R9614 | 1 |
| R9233 | 2 | R9615 | 1 |
| R9234 | 1 | R9616 | 1 |
| R9237 | 2 | R9617 | 1 |
| R9241 | 1 | | |
| R9242 | 1 | | |
| R9243 | 2 | R9701 | 1 |
| R9245 | 1 | R9704 | 1 |
| R9247 | 1 | R9705 | 1 |
| R9248 | 1 | R9709 | 1 |
| R9249 | 1 | R9710 | 1 |
| R9250 | 2 | R9711 | 1 |
| R9251 | 2 | R9712 | 1 |
| R9254 | 1 | R9714 | 1 |
| R9255 | 2 | R9715 | 1 |
| R9258 | 2 | R9716 | 1 |
| R9261 | 1 | R9717 | 1 |
| | | R9718 | 1 |
| | | R9719 | 1 |
| R9401 | 2 | R9720 | 1 |
| R9405 | 2 | R9721 | 1 |
| R9407 | 1 | R9722 | 1 |
| R9409 | 1 | | |
| R9413 | 1 | | |
| R9415 | 1 | R9801 | 1 |
| R9417 | 1 | R9804 | 1 |

### Switches

Stock only one for each of the following switches for each 3 units being maintained:

**S910, S911, S920, S930, S960, S990, S991**

*Note:* Should a particular switch receive more than normal use in certain applications, then the quantity stocked of that particular switch should be doubled.

### Networks

| Symbol | Quantity |
|---|---|
| Z9401 | 1 |

Type 7001 Delay Line (Option)

### d. Miscellaneous

The following items may be stocked in quantities of one for each 2 units being maintained:

| Name | Part Number |
|---|---|
| Connector, BNC | 0905 7610 |
| Jack, ground | 0905 8500 |
| Bushing, shaft (Gain Adj) | 4301 3581 |
| Knob, GP #2 (Volts/Div) | 4500 8945 |
| Knob, fastener | 4501 0431 |
| Knob, small (Variable) | 4501 2232 |
| Knob, small (Norm/Invert) | 4501 2022 |
| Knob, small (Position) | 4501 2024 |

### e. Summary

The quantities of spare parts given in the preceding paragraphs are intended for industrial and military duty under normal environment and heavy-use conditions. It is suggested that the maintenance engineer evaluate:

1. The conditions under which the instruments will be used.
2. The skill of the maintenance technicians.
3. Other similar items on hand.
4. The effect of procurement time of spares and effects of instrument down-time on your organization.

It is recommended that inventories of spare parts outlined above be adjusted according to the requirements of your own laboratory or plant.

In the first analysis, the factory recommends the availability of spares or standby equipments since extensive life testing of your instrument has shown no higher failure rate for any specific component.

# LIST OF RECOMMENDED VENDORS

| CODE | NAME |
|---|---|
| ABD | Du Mont Laboratories |
| AER | Aerovox Corporation |
| AHH | Arrow-Hart & Hegeman Electric Company |
| ALB | Allen-Bradley Company |
| ALC | Allied Control |
| ALCO | Alco Electronic Products |
| ALD | Alden Products Company |
| AMA | Amaton Electronic Hardware |
| AMP | Amp Inc. |
| AMR | Amperite Company, Inc. |
| AMX | Amperex Electronics Products, Inc. |
| APC | American Phenolic Corporation |
| APH | Amphenol Electronics Corporation |
| ARC | Arco Electronics Inc. (Elmenco) |
| AST | Astron Corporation |
| AUT | Automatic Metal Products Corporation |
| BEL | Belfuse |
| BNS | Bourns Inc. |
| BUR | Burndy Engrg. Company |
| BUS | Bussmann Mfg. Company |
| CAN | Cannon Electric Company |
| CBS | CBS-Hytron Division of CBS |
| CDE | Cornell-Dubilier Electric Corporation |
| CGW | Corning Glass Works |
| CH | Cutler-Hammer, Inc. |
| CHC | Chester Cable Corporation |
| CHM | Chatham Electronics |
| CIN | Cinch Manufacturing Company |
| CLS | Clarostat Mfg. Co., Inc. |
| COC | Continental Carbon |
| COM | Comar Electric |
| COW | Continental-Wirt Electronics Corporation |
| CPC | C. P. Clare & Company |
| CRL | Centralab, Division of Globe-Union, Inc. |
| CST | Chicago Standard Transformer Corporation |
| CTC | Cambridge Thermionic Corporation |
| CTS | Chicago Telephone Supply Corporation |
| DAG | Dage Electric Company, Inc. |
| DAL | Dale Products, Inc. |
| DLC | Dialight Corporation |
| DRK | Drake Mfg. Company |
| EBY | Hugh H. Eby, Inc. |
| EDL | Edal Industries |
| EIA | Any manufacturer meeting EIA standards |
| ELC | Electra Manufacturing Company |
| ELD | Eldema Corporation |
| EMC | Electro Motive Mfg. Company |
| EMW | Elmwood Sensors, Inc. |
| ERC | Erie Resistor Corporation |
| ESX | Essex Electronics |
| FAST | John E. Fast Company |
| FCI | Fairchild Camera and Instrument Corporation |
| FER | Ferroxcube Corporation of America |
| GDE | Good-All Electric Mfg. Company |
| GE | General Electric Company |
| GEN | General Instrument Corporation |
| GEP | General Products Corporation |
| GLB | Globe Industries |
| GRC | General Radio Company |
| GRY | Grayhill, Inc. |
| GUD | The Gudeman Company |
| HAM | The Hammarlund Manufacturing Co., Inc. |

| CODE | NAME |
|---|---|
| HON | Honeywell |
| HOP | Hopkins Engineering Company |
| HP | Hewlett-Packard Company |
| IEC | International Electronics Corporation |
| IRC | International Resistance Company |
| IRP | International Rectifier Corporation |
| ITT | ITT Components Division |
| JEF | Jeffers Electronics, Inc. |
| JHN | E. F. Johnson Company |
| JWM | J. W. Miller Company |
| KUL | Kulka Electric Mfg. Co. Inc. |
| KXM | Klixon Metals and Control Corporation |
| LED | Ledex Inc. |
| LEE | Leecraft Mfg. Company |
| LFI | Littlefuse, Inc. |
| LIN | Line Electric |
| MAL | P. R. Mallory & Company, Inc. |
| MCR | Micro Switch (Division of Minneapolis-Honeywell Regulator Co.) |
| MIC | Micamold Electronics Mfg. Corporation |
| MIL | Miller Electric Company |
| MOT | Motorola Semiconductor Products, Inc. |
| MOV | M-O Valve Company Ltd. |
| MUC | Mucon Corporation |
| MUT | The Muter Company |
| NYT | New York Transformer Company, Inc. |
| OAK | Oak Mfg. Company |
| PHC | Philco Corporation |
| PHI | Philips Electronic Tube Division |
| PLS | Plastoid Corporation |
| POT | Potter & Brumfield, Inc. |
| PRC | Precision Resistor Co., Inc. |
| PYR | Pyramid Electric Company |
| RCA | Radio Corporation of America |
| RMC | Radio Materials Corporation |
| ROY | Royal Electric Corporation, Inc. |
| RTN | Rotron Mfg. Company |
| SIG | Signalite Inc. |
| SIL | Silicon Transistor Corporation |
| SLT | Sealectro Corporation |
| SOL | Solitron Devices, Inc. |
| SPG | Sprague Electric Company |
| STC | Stackpole Carbon Company |
| STW | Standard Winding Company |
| SUM | Summit Coil Company |
| SWW | Stanwyck Winding Company |
| SYL | Sylvania Electric Products, Inc. |
| SYN | Syntronic Instruments, Inc. |
| TEC | Transistor Electronics Corporation |
| TEX | Texas Instruments, Inc. |
| THC | Thermal Control, Inc. |
| TOR | Torrington Mfg., Company |
| TRS | Tresco, Inc. |
| TRU | Tru-Ohm Products |
| TUG | Tung-Sol Electric Inc. |
| UCN | Ucinite Company |
| UTC | United Transformer Company |
| VIC | The Victoreen Instrument Company |
| WDE | Wood Electric Corporation |
| WDL | Ward Leonard Electric Company |
| WES | Weston Electrical Instrument Corporation |
| WYN | Welwyn International Inc. |

# INSTRUMENT WARRANTY AND SERVICE NOTICE

## WARRANTY

The Scientific Instrument Department warrants that each new Cathode-ray Oscilloscope, Automotive Test Equipment, and other Electronic or Electrical Test or Measuring Equipment (hereinafter referred to as "Instrument") manufactured or sold by it, is free from defects in material or workmanship under normal use and service for a period of one year from the date of its sale to the first purchaser for use. If, upon examination by Fairchild, the Instrument is determined to be defective in workmanship or material, Fairchild will, subject to the conditions set forth below, either repair the defective part or replace it with a new part. Fairchild shall not be liable for any delay or failure to furnish a replacement part resulting directly or indirectly from any governmental restriction, priority or allocation or any other governmental regulatory order or action, nor shall Fairchild be liable for damages by reason of the failure of the Instrument to perform properly or for any consequential damages. This warranty does not apply to any Instrument that has been subject to negligence, accident, misuse or improper installation or operation or that in any way has been tampered with, altered or repaired by any person other than an authorized Fairchild service organization or an employee thereof, or to any Instrument whose serial number has been altered, defaced or removed, or to any Instrument purchased within, and thereafter removed beyond, the continental limits of the United States.

This warranty shall, at Fairchild's option, become void unless registration thereof is promptly effected as provided below. This warranty is in lieu of all other warranties, expressed or implied, and no one is authorized to assume any liability on behalf of Fairchild or impose any obligation upon it in connection with the sale of any Instrument, other than as stated above.

## REGISTERING THE WARRANTY

To register this warranty, the enclosed warranty registration card must be properly filled out and mailed to the Instrument Service Department immediately upon receipt of the equipment. Complete information is necessary. BOTH THE TYPE NUMBER AND THE SERIAL NUMBER OF THE INSTRUMENT MUST BE GIVEN ON THIS CARD. Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

## CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold, or to supply new equipment in accordance with earlier specifications excepting under the classification of special apparatus.

## SERVICE

In order to insure service under our warranty, the enclosed warranty service card must be properly filled out and returned to the factory. In all cases where service or adjustment is requested, please first contact the factory or authorized depot giving complete information concerning the nature of the failure and describing the manner in which the equipment was used when failure occurred. THE TYPE NUMBER AND SERIAL NUMBER of the equipment must also be given. In this way, much time can be saved and unnecessary inconvenience often avoided. When writing to the factory in this respect, address:

Fairchild Camera and Instrument Corp.
Instrumentation Division
50 Somerset Place, Clifton, New Jersey

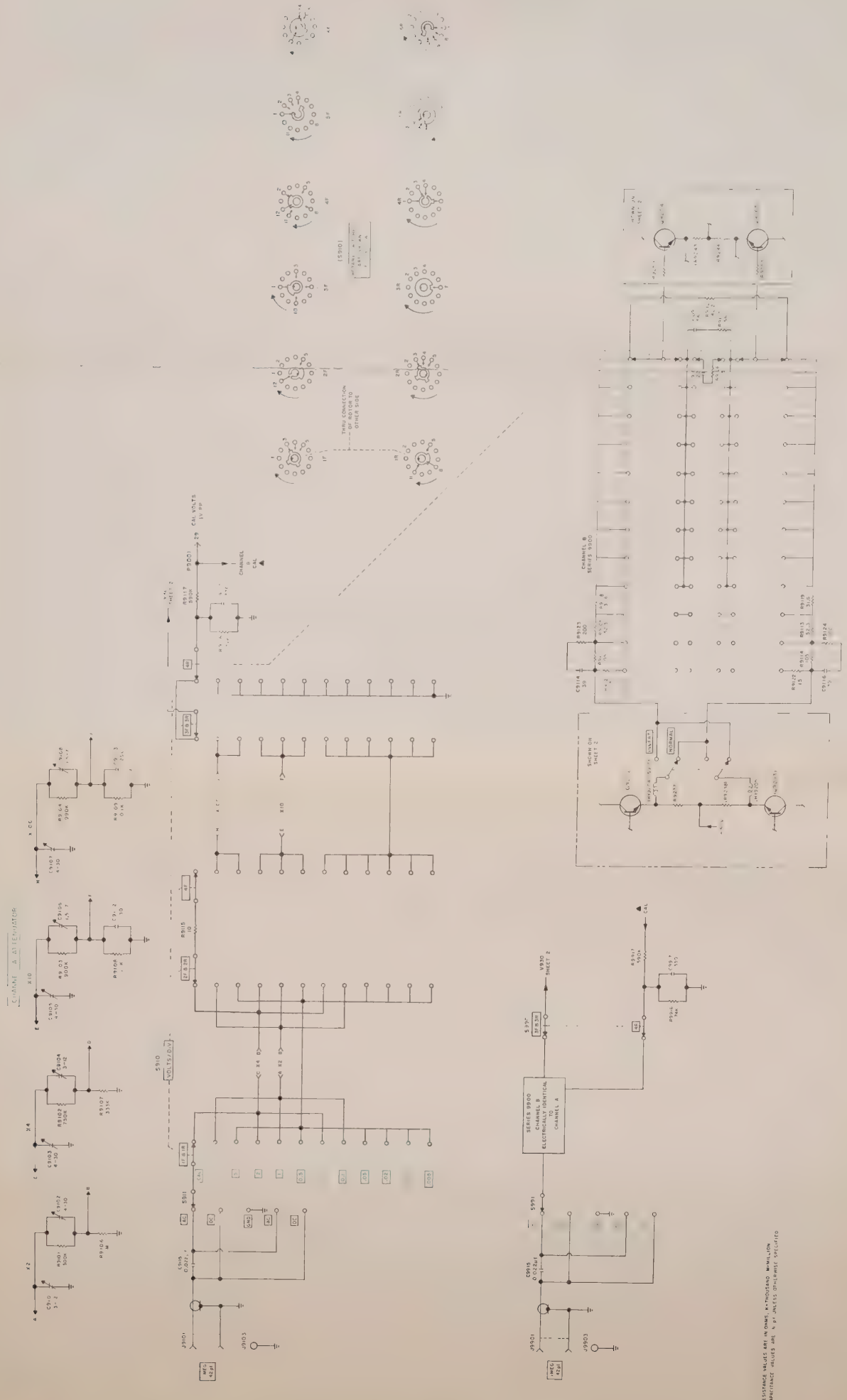
The Instrument Service Department will then send to the customer the written procedure for disposition and shipping instructions. All equipment should be packed and shipped in accordance with this procedure; and identification tags should be attached to each tube or instrument.

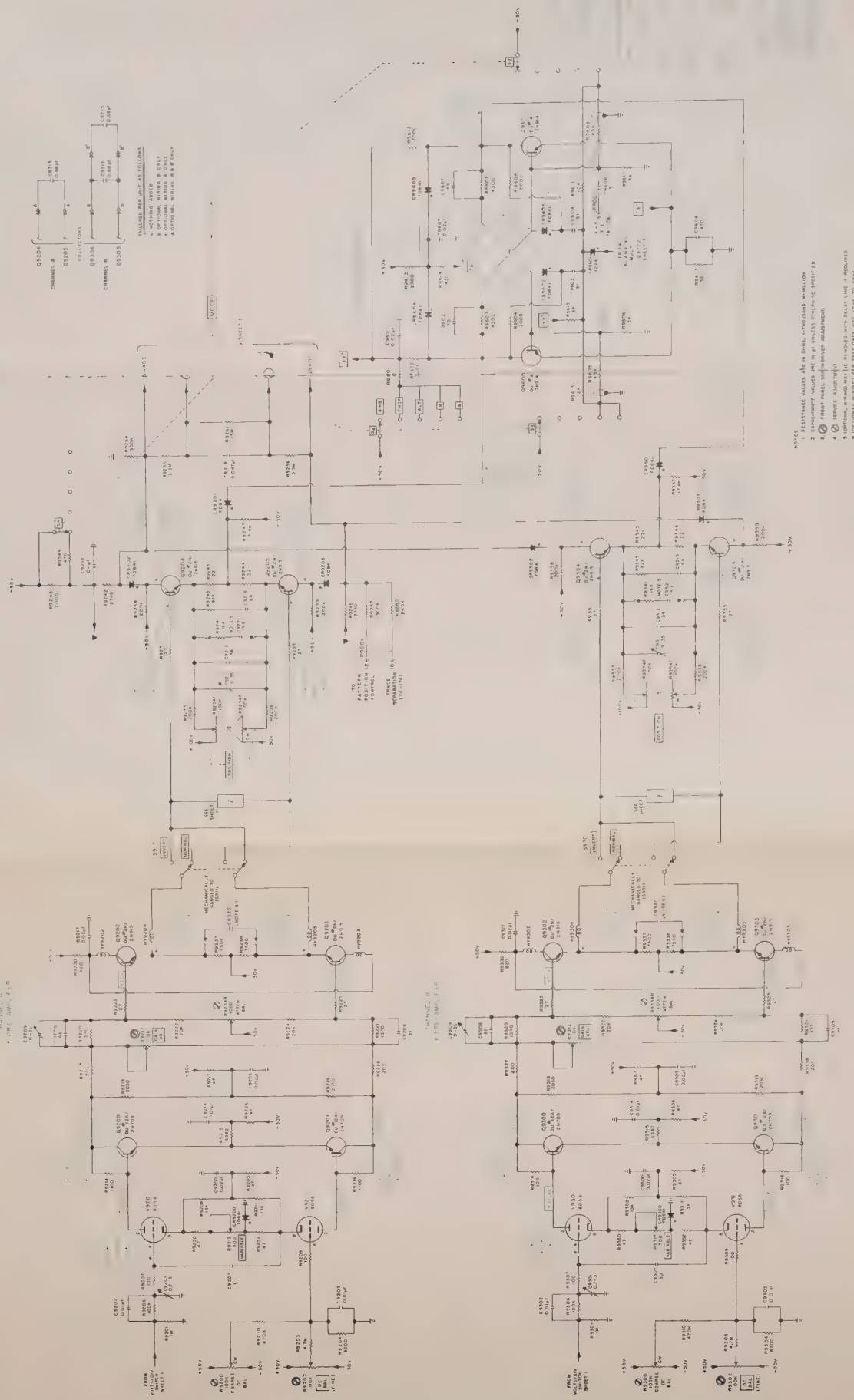
## REPLACEMENT PARTS

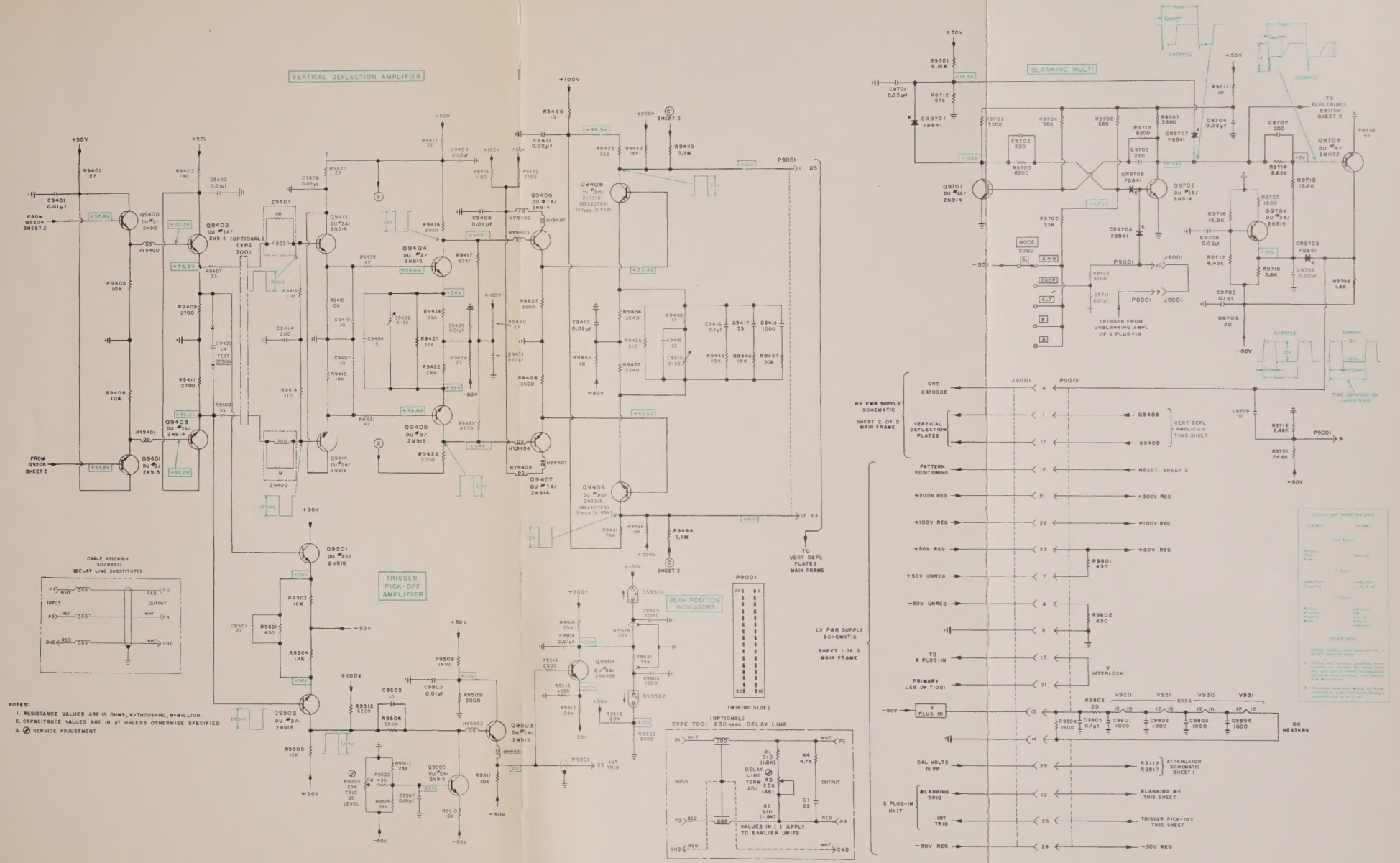
If it is necessary to order a replacement component from the factory, always give the Type number and Serial number of the Instrument. Before ordering parts for in-warranty replacement or purchasing them for out-of-warranty replacement, be sure to consult the Parts List in the Instruction Manual. The Parts List gives the values, tolerances, ratings, and Fairchild part number for all electrical components used in the Instrument. This will help to expedite service.

## PATENT NOTICE

Manufactured under one or more U. S. Patents owned or controlled by Fairchild Camera and Instrument Corporation, 50 Somerset Place, Clifton, New Jersey, U.S.A. Patent Numbers supplied upon request.


CHANNEL A ATTENUATOR
X10
X4
X2
X CC
P5001
CAL VOLTS
CHANNEL B CAL
S910
VOLTS/DIV
S911
J9101
J9103
J9901
J9903
SERIES 9900 CHANNEL B ELECTRICALLY IDENTICAL TO CHANNEL A
Channel B SERIES 9900
SEE SHEET 2
NORMAL
TURN ON SHEET 2
THRU CONNECTION TO BOARD ON OTHER SIDE
NOTES
1 RESISTANCE VALUES ARE IN OHMS, K=THOUSAND, M=MILLION
2 CAPACITANCE VALUES ARE IN μF UNLESS OTHERWISE SPECIFIED




VERTICAL DEFLECTION AMPLIFIER
BLANKING MULTI
TRIGGER PICK-OFF AMPLIFIER
BEAM POSITION INDICATORS
TYPE 7001 (OPTIONAL)
230 nsec DELAY LINE
CABLE ASSEMBLY 502985?
(DELAY LINE SUBSTITUTE)
INPUT
OUTPUT
TO VERT DEFL PLATES MAIN FRAME
TO ELECTRONIC SWITCH SHEET 2
TRIGGER FROM UNBLANKING AMPL OF X PLUG-IN
TIME DEPENDS ON SWEEP RATE
CRT CATHODE
VERTICAL DEFLECTION PLATES
PATTERN POSITIONING
+200V REG
+100V REG
+50V REG
+50V UNREG
-50V UNREG
TO X PLUG-IN
PRIMARY LEG OF T1001
CAL VOLTS 1V PP
BLANKING TRIG
INT TRIG
-50V REG
X PLUG-IN UNIT
LV PWR SUPPLY SCHEMATIC
SHEET 1 OF 2 MAIN FRAME
HV PWR SUPPLY SCHEMATIC
SHEET 2 OF 2 MAIN FRAME
VERT DEFL AMPLIFIER THIS SHEET
ATTENUATOR SCHEMATIC SHEET 1
BLANKING MV THIS SHEET
TRIGGER PICK-OFF THIS SHEET
DC HEATERS
NOTES:
1. RESISTANCE VALUES ARE IN OHMS, K=THOUSAND, M=MILLION.
2. CAPACITANCE VALUES ARE IN pf UNLESS OTHERWISE SPECIFIED.
3. SERVICE ADJUSTMENT